ISIS

International Review devoted to the History of Science and Civilization.

SUMMARY

of No. 9 (Vol. III, 3d and last part), Brussels, Belgium, Summer 1921.
(Edited Cambridge, Mass., September 1920.)

I. *Main Articles.*

Pages

George Sarton. — Herbert Spencer (with bibliographical and iconographical notes and portrait) . . . 375

Edmond Goblot *(Lyon)*. — Gaston Milhaud (with portrait) 391

L. C. Karpinski *(Ann Arbor, Mich.)*. — Two Twelfth Century Algorisms 396

Florian Cajori *(Berkeley, Calif.)*. — History of Symbols for *n*- Factorial 414

II. *Notes and Correspondence.*

The Unity History Schools at Woodbrooke, near Birmingham (G. S.). 419

Courses on the History of Science at University College, London (G. S.). 419

The International Organization of Science (G. S.) 420

III. *Reviews.*

S. II. Schütte, Gudmund, Ptolemy's Maps of N. Europe Copenhagen, 1917 (G.S.). 422

S. XV. Bensaude, Joaquim. Histoire de la science nautique portugaise. Genève, 1917 (G.S.) 424

S. XIX. Lespieau, R. La molécule chimique. Paris, 1920 (Guinet) . 426

Sastri, Sivanath. History of the Brahmo Samaj. Vol. I-II. Calcutta, 1911-1912 (G.S.) 428

Pages

Antiquity. Stéphanidès, M. Contributions à l'histoire des sciences et particulièrement de la chimie (en grec). Athènes, 1914 (G. S.) 430

Diels, Herman. Antike Technik. 2te aufl. Leipzig, 1920 (G. S.) . 433

Islam. Carra de Vaux, Bernard. Notes d'histoire des sciences Paris, 1917 (G. S.) 434

Middle Ages. Singer, Charles. Early English Magic and Medicine. London, 1920 (G. S.). 435

Astronomy. Müller, Franz Joh. Studien zur Geschichte der theoretischen Geodäsie. Augsburg, 1918 (G.S.) 438

Biology. Driesch, Hans. The History and Theory of Vitalism. London, 1914 (G. S.). 439

Chemistry. Hjelt, Edw. Geschichte der organischen Chemie. Braunschweig, 1916 (G. S.). 440

Letts, E. A Some fundamental problems in chemistry. London, 1914 (G.S.). 443

Geology. Ruska, Julius. Methodik des mineralogisch-geologischen Unterrichts. Stuttgart, 1920 (G. S.). . . 443

Metzger, Hélène. La genèse de la science des cristaux. Paris, 1918 (Guinet) 445

Mathematics. Dickson, L. E. History of the Theory of Numbers. Vol I. Washington, 1919 (Child) 446

Philosophy. Sagheret, Jules. La vague mystique. Paris, 1920 (Guinet). 448

Superstition. Butler, Hiram E. Solar Biology, 23d ed. Applegate, Calif., 1920 (G. S) 449

IV. *Ninth Critical Bibliography of the History, Philosophy and Organization of Science and of the History of Civilization* (to August 1920) 451

V. *Table of Contents of the First Nine Critical Bibliographies including a Table of Contents of vol. I, II, III* . 498

VI. *Errata* 503

VII. *Index to Volumes II and III* 504

Herbert Spencer (1)

1820-1903

There seems to be a rhythm in history, a sort of gigantic human ebb and flow, according to which men are periodically brought together in closer unison or driven asunder. These tides are not restricted to the sentimental sphere but involve as well our intellectual activities and, in fact, they seem to pervade the whole of human life. Thus in the XIII^th century one common faith intensified the solidarity of a great number of peoples, and at the same time we witness an immense effort toward synthetic knowledge and a wonderful efflorescence of a self-forgetting art. The XV^th century on the contrary leaves one the impression of a period of decomposition, of searching analysis, of violent individual conflicts.

To all external appearances we are now crossing a period of ebb, when the centrifugal forces far exceed the centripetal ones, when man is more conscious of his own precious self than of the rest of humanity, more concerned about his material than his religious needs, more prone to assert himself than to own any deep solidarity with his fellow men. Of course we are more keenly aware of it because of the spasmodic union caused by the war. It would be very foolish to mistake this war solidarity for a real increase in human cohesion, for, as I have said, the flow does not affect simply one part of our soul but the whole of it. A common fear and a common hatred are entirely unable to create an all-pervading faith. Hence in spite of the many examples of heroism and absolute devotion which the war has brought to light, we can but feel that, then as now, human affairs were at a very low ebb. The war may well have marked the nadir of the present depression. Other ominous symptoms are not lacking : divergent

(1) By permission from *Scribner's Magazine* for June, 1920, copyright, 1920, by CHARLES SCRIBNER'S SONS.

forces are everywhere more apparent than the convergent ones. A great many men and women seem to have no higher ideal in life than to be « different » and « exclusive ». Our artists are determined to be original at any price. As to the scientists they shut themselves more and more out of the world and live like clams in their little shells. Pray, what can the wide world mean to a clam?

How shall we ever emerge from the present anarchy? Well, because of the unity of our life, and because of the fact that this ebb and flow interests every part of our soul, it is clear that any attempt to lift up any part of it will help us gradually to emerge and to recover. Of course complete recovery will only be possible when a great many of us pull together with our whole strength. But it is not necessary that we pull on the same ropes. One may struggle for greater brotherhood, another for more unselfish art, another for synthetic knowledge; their cause is the same and they actually pull together.

It cannot be denied that synthetic or encyclopædic knowledge is very little understood nowadays. Most people, including the majority of the scientists themselves, look down upon it with nothing but distrust and scepticism. This is due partly to the fact that the very progress of science implies an ever-increasing specialization of research, partly to the materialistic tendencies of our age — people care more for practical results than knowledge — partly to the fact that there is so little genuine encyclopædic knowledge and so much which is faked and worthless. It is easy to answer to the first objection : no man in his senses believes that there is too much analytic research, but simply that, however much of it there be, it must be balanced by a corresponding amount of co-ordinating work. The last objection is but too painfully just. We are all acquainted with men who will argue brilliantly about everything under the sun and yet who are unable to add anything to the total experience of humanity. Such people are of very little account. The dullest specialist at least knows something; they know nothing whatever. Unfortunately, it happens but too often that their empty discourses are mistaken for true synthetic knowledge with the result that such knowledge is unjustly despised.

It is worth while to go a little more deeply into the matter and to answer the two following questions : Is synthetic knowledge desirable and should it be encouraged? And if so, is it possible for any man, however intelligent, to acquire it?

An excellent way of approaching these two questions is to consider

the concrete case which the life of HERBERT SPENCER — the latest synthetic philosopher — offers to us. He was born just a hundred years ago. It occurred to me that while returning to him with reverence on the occasion of his centenary, we might take advantage of our pilgrimage to examine whether the ideal to which he devoted his life was a sensible one and how far he succeeded in attaining it. We are less anxious to know the results he arrived at than to test the value of his method. The problem is then : « Was SPENCER right in trying to do what he did? Is it worth trying again? » Of course, from this new angle, his failure becomes just as interesting as his success, because they help us equally to solve the next practical problem : « How can we again do what he did, and do it better? »

The life of a philosopher is generally less exciting than that of a war correspondent or a prima donna. SPENCER's life is a very plain one indeed. If one does not insist on quoting the titles of the books and essays, which are the most conspicuous mile-stones of his career, it can be told in a few words. He was born in Derby on April 27, 1820, a thoroughbred Englishman. His father, GEORGE SPENCER, was a teacher, a man of small means and little imagination, but honest to the core and of an unbending type. His mother, who does not seem to have influenced him to any extent, was very different from her husband, as patient and gentle as he was irritable and aggressively independent. They do not seem to have been very happy together, and their union was not blessed with many children who survived; although nine were born to them, only one, HERBERT, the eldest, passed the stage of infancy. It is as if already the parents had been obliged to pay the heavy ransom of genius. The boy was left a great deal to himself, and he followed his bent toward scientific information, learning also a little English and arithmetic. At the age of thirteen, he was sent to his uncle, the Reverend THOMAS SPENCER, but the discipline of this new home seemed at first so hard to him that he ran away to his father's, walking one hundred and fifteen miles in three days with hardly any sleep or food. However, after a while he returned to his uncle and stayed with him, being tutored by him, chiefly in mathematics, for the next three years. This was the end of his systematic education, which certainly was very incomplete. When he began to earn his living at sixteen, he knew probably less than the average well-to-do boy of his age. It is true he knew considerably more in other ways, and he had also exercised to a greater extent his mother-wit. Then he worked successively as an assistant school-

master (for three months), as an engineer, and, after a vain attempt to earn a living as a literary man, he finally became in 1848 sub-editor of the *Economist*. This last position had the advantage of bringing him into touch with many eminent men of his day; men like HUXLEY, TYNDALL, and LEWES. During all these years, he had carried on desultory reading, he had made quite a number of trivial inventions, he had done some writing and a considerable amount of solitary thinking.

The editing of the *Economist* left him time enough to complete his first book, « Social Statics », which appeared early in 1851. In 1853, having inherited five hundred pounds from his uncle, he abandoned this position and determined to support himself by his own literary work. Such is always a very hazardous decision, never more, however, than in the case of a man who is less a writer than a thinker, a slow and hard thinker, whose ability to express himself is constantly inhibited by the fear of error. Shortly afterward, after a holiday in Switzerland, his health began to break down. Yet he resolutely pursued the self-imposed task of which he became more and more conscious, and after many years of work and meditation, of suffering and disappointment, on March 27, 1860, he published the programme of « A System of Philosophy », the outline of the work to which the best part of his life was to be devoted. This is to me the culminating date in SPENCER's life. It is then that he reveals for the first time his dominant personality.

Think of it! Here we have a man, whose systematic knowledge is rather small, whom many scientists (not the greatest, however) would have regarded as ignorant — and such he was in many respects —, a man handicapped by lack of means and of health, but one who has been thinking hard and fast for a number of years, who has measured the world around him and himself, who knows exactly what he must do, who calmly estimates the immensity of the undertaking and the frailty of the means, who knows that his decision practically involves the surrender of his liberty for the rest of his days and makes of him a slave to his ideal — yet his faith is so great that he does not hesitate. No handicap will stop him and he sends his programme to the world; a programme to the fulfilment of which the rest of his life was faithfully and unrestrictedly given. One should keep in mind that at that time SPENCER was already a nervous invalid; he could only work a few hours a day and had to use all sorts of tricks to do so without suffering; in the afternoon he had to forsake not simply work but any excitement or he would lose his night's rest. Yet he

went ahead and henceforth his life was one of single-hearted devotion to his self-imposed trust. The first volume of the « Synthetic Philosophy » appeared in 1862, the tenth and last in 1896. It took him thirty-seven years to go over the top.

It is not part of my present purpose to analyze, even briefly, SPENCER's works. I will simply limit myself to a few remarks wich may refresh the reader's memory and help him to appreciate SPENCER's undertaking. Let us remember that his fundamental ideas are the following: First, an earnest belief in the value of philosophy as completely unified knowledge. Of course, without such belief, he could not have carried on his life's work. Secondly, the modern concept of evolution both in its biological and its universal import. Thirdly, the ideal of freedom — the core of his political thought.

I need not consider the first point because my whole essay is really devoted to it. It is remarkable that SPENCER's first paper on evolution, one entitled « The Development Hypothesis, » appeared as early as 1852, and his system of philosophy, which was essentially based upon the law of progress, was drafted by him for the first time in the early days of 1858. It is in the middle of the same year that DARWIN and WALLACE announced their theory of natural selection to the Linnæan Society of London. SPENCER's merit as a precursor cannot be denied; at the same time it must be said that if his general theory of evolution was right, his conception of its mechanism was wrong. He believed that biologic progress was chiefly determined by the inheritance of characteristics gained by each individual during his lifetime, and although he later admitted the validity of DARWIN's explanation, that is, natural selection (it is SPENCER, by the way, who coined the popular phrase « struggle for life »), he remained a Lamarckian to the end of his life. Biologists are now generally agreed that acquired characters are *not* inherited, but their agreement on this subject is so recent that it would hardly be fair to blame SPENCER on this score. Moreover, he was the first to extend this theory to a general conception of the universe and to retrace in the development not simply of living organisms but of everything an evolution or a progress « from the homogeneous to the heterogeneous, from the simple to the complex, from the incoherent to the coherent, from the indefinite to the definite ». Matter-of-fact people may object that such a generalization is equally uncontrollable and useless, but that is to take a very crude view of the subject. SPENCER's generalization, his insistence, was a powerful factor in the success of the evolutionary point of view. It

helped mightily to create a new scientific and philosophic atmosphere. Is not that very much indeed, and what more could you expect a philosopher to do?

The « Synthetic Philosophy » did not embrace all the sciences. Feeling the necessity of restricting his field, chiefly on account of his insufficient scientific training, he made a systematic study only of those branches of knowledge to which the application of scientific methods was relatively new, to wit : biology, ethics, sociology. Biological facts had inspired his theory of evolution, and his biology in turn was dominated by it. On the other hand, in his ethical and social studies he was chiefly guided by the conception that liberty is the greatest good. The industrial and legal development of the last half-century seems to have proceeded in the opposite direction; yet the main difficulties of our moral and social life cannot be solved by artificial regulations, and now, even more than in SPENCER's time, the greatest political problem to be solved is the one involved in the antinomy : freedom *versus* red tape, or initiative *versus* automatism, or life *versus* stagnation. Of course we all realize that a great many more regulations and social restrictions are needed than SPENCER was prepared to admit, but the wise do not believe that these regulations are real factors of progress. The best that they can do is to prevent us from sliding backward; they cannot help us to go onward. They impede a certain amount of evil and they oblige another amount of it to assume a secret form, which may be on the whole less pernicious. They cannot create any parcel of positive good. SPENCER's searching analysis of these subjects is of permanent value, and even if one assents to the temporary necessity of compulsory measures, there is no doubt that social progress lies mainly in the direction which he pointed out, the increase of *voluntary* co-operation.

SPENCER has often been reproached that his system is based far more upon preconceived ideas than upon the observation of reality. Yet it must be admitted that he managed to marshal an enormous mass of facts to support his theories. If it be true that the latter were generally ahead of his experience, is not the same true to a certain extent of every scientific hypothesis? Never mind where a man gets his theories if he can establish them on experimental grounds. And SPENCER, however biassed and ignorant he may have been, took enormous pains to gather the experimental facts which he needed. Think only of the descriptive sociology whose publication under his direction began in 1873 and is not yet completed. Although

he was very poor in the first half of his life and never reached more than a small competence, he spent more than three thousand pounds on this great undertaking. It is a pity, by the way, that the frame of these descriptions is so rigid and their size so awkward, but as they are, the published volumes contain an enormous amount of material and deserve greater recognition than they have ever received.

SPENCER's main shortcoming was his dogmatism, his inability to consider the opinions of others. This dogmatism, which naturally increased as he grew older, arose partly from his initial ignorance, partly from his chronic neurasthenia, partly also from his lack of imagination, the singleness of his purpose, the exclusiveness of his thought. He was temperamentally a non-conformist, and although later in life he seemed to become more and more anxious to comply with the external conventions of society, I suppose he did so chiefly to eschew the criticism of fools and to protect his inner freedom.

There is no justification whatever for the statement that SPENCER was « all brains and no heart ». He was not sentimental, but very sensitive. Of course the accomplishment of his life's work did absorb the greatest part of his energy, including his emotional energy, and a man carrying such a burden on his shoulders could not be expected to run errands for others.

As in the case of LEONARDO DA VINCI, the predominance of his intellectual concerns partly explains his sexual indifference, which overwhelming interests of another sort could but aggravate, as they became more engrossed in their work. At any rate, SPENCER does not seem to have ever experienced love. When he was twenty, he came nearer to it than ever before or afterward, but this little encounter seems very shadowy indeed and would not even be quoted in the biography of a more normal person. Later, while he was editing the *Economist*, he often took to the theatre, to share his free tickets, a young girl (she was a year older than he) who then enjoyed some small notoriety for her translation of STRAUSS's « Life of JESUS ». They saw a great deal of one another, but although there is no woman for whom SPENCER ever had a higher esteem, there is no warrant for the statement that they ever were in love. Leaving temperament aside, maybe if SPENCER had had a little more imagination and pluck, they would have married. And just try to imagine what would have happened if HERBERT SPENCER and GEORGE ELIOT had been man and wife! Pity that such experiments are impossible and that each life is definitive. Anyhow, I do not think, as far as I know them both, that

SPENCER would have made her happy; at least he could not have inspired her as deeply as did, later, GEORGE HENRY LEWES.

It is very interesting to compare SPENCER and COMTE, and I love to bring them together in the field of my memory. SPENCER did not like allusions to COMTE apropos of himself, and he refused to own any indebtedness to his illustrious predecessor. It is true that he never made a formal study of COMTE's works, yet he knew more of them than he was himself conscious of, as the result of his conversations with his friends, chiefly GEORGE ELIOT and GEORGE LEWES, who were at one time enthusiastic followers of the French philosopher. They certainly had many opportunities of imparting to SPENCER, willy-nilly, the gist of COMTE's ideas.

However different the great Frenchman and the great Englishman were, they had very much in common. First of all their encyclopædic ideal, then their heroic faith and tenacity amidst untoward circumstances, their intolerance and dogmatism, their independence, their lack of those softening qualities which make men lovable. They attached a paramount importance to the study of sociology and positive polity, but they clearly saw that no real advance can be made which is not preceded by a moral transformation. They both asserted themselves in a similar way. AUGUSTE COMTE wrote the first sketch of his « Course of Positive Philosophy » in 1826, and the course itself was the labor of the next sixteen years; SPENCER launched his manifesto in 1860, and working far more slowly, it took him more than double this time to produce the whole of his own synthesis.

Although both saw the importance of historical methods, they still have in common an extraordinary lack of historical sense. I am thinking of COMTE, the philosopher—not of the prophet of his latter days, who, jumping to the other extreme, made of history a sort of religion. Before that, he does not seem to have grasped any more clearly than SPENCER that genuine synthetic knowledge must comprehend the whole past of knowledge as well as its latest stages. Knowledge indeed is not something fixed and rigid, neither is it perfect; it is an ever-progressing organism whose meaning can only be understood by him who knows its origin and its inner life. COMTE saw well enough that the history of intellectual development is the key to social evolution, but he did not see that it is also a master-key to synthetic knowledge. SPENCER generously spent considerable sums for the elaboration of his « Descriptive Sociology », wherein the chronological sequence of events is faithfully abided by; yet what

one might call his historical blindness was appalling. Nothing is more pitiful, nothing more calculated to make one doubt of his genius, than the meagre notes he wrote while travelling in Egypt and Italy; to him the past was dead.

In my sketch of SPENCER's life, I hope I have made it clear how ill prepared he was for the great undertaking upon which he had set his heart. At first view it seems unbelievable that he could do as much as he did with such inadequate equipment. In fact, he was not by any means as ignorant as one would expect such a poor student to be. If he had but few opportunities of systematic research or set studies, he had plenty, in his miscellaneous readings and his talks at the Athenæum or in the streets with the most distinguished of his contemporaries, to gather in a substantial amount of first class information. His sharp and ready mind could make the most of the vaguest hint. Being endowed with a real genius for synthesis and possessing a complete system of knowledge, he could at the same time keep out all superfluous information, and let in, and classify at once, all that which was pertinent to his purpose.

In short, SPENCER's mind was a genuine encyclopædic mind. The relative smallness of his knowledge was largely compensated by its congruity. The contemplation of such a mind helps one better than any explanation to understand what synthetic or encyclopædic knowledge actually is. It is not a mere accumulation of disconnected facts and theories. There are men who know thousands of facts, but have no skill in ordering them, no hooks in their brains to hang them on. The disintegrated knowledge of these men, of whom good people often speak as being very learned, is as remote from synthetic knowledge as crass ignorance. Knowledge is synthetic to the extent that it is unified, congruous, and the result of an organic growth. It cannot be obtained by mere juxtaposition of odd bits, but only by a slow digestion and re-elaboration of all the materials which the mind selects and absorbs.

Nevertheless, the lack of a systematic training at the outset of his life was to SPENCER a considerable and, to a large extent, an irretrievable handicap. Genius cannot entirely make up for the absence of the fundamental technique which can only be properly acquired when one is young. It is astounding that, barring such as were unavoidable at the time of his writing, there are not more errors in SPENCER's philosophy, and that there is so much truth — truth of his day and prophetic truth — in a system resting on such a fragile

foundation. Indeed the amount of active substance which his works contain is unusually great; an excellent proof of this is afforded by the extraordinary influence they exerted upon the intellectual development of the end of the XIXth century.

The unification of knowledge is the more necessary as knowledge becomes more complex and specialized. If nobody had the courage to attempt it, the scientific world would soon become a new Tower of Babel. There are already too many specialists who know what they are doing hardly more than bees do. They work faithfully in their little corner, and their work is very useful. But science is far more than the sum of their fragmentary efforts. The growth of science is essentially an organic growth. That means that at least a few people must take the trouble to digest and assimilate the whole of it, in order to co-ordinate and to unify it. They may err; nay, they are bound to err ever and anon; but where one will err, the next one will go straight. It is so that everything progresses.

If encyclopædic efforts were abandoned, the amount of scientific facts and little theories might go on increasing indefinitely, but science would perish. The same is equally true of every human activity. Everywhere synthetic and centripetal endeavors must counterbalance the more special and centrifugal ones, lest the whole fabric of life be ruined and fall to pieces. Business men, for instance, have a very clear notion of this, and in proportion as they standardize and specialize their industries, they are careful to provide co-ordinating agencies to keep the complete body together.

But many will hasten to object : « Encyclopædic knowledge, however desirable it may be, has become impossible. Science is becoming vaster every day and men do not seem to grow bigger. Indeed they seem smaller than they were in the past. There are no more ARISTOTLES, and if one of these giants were to come back, the immensity of accumulated knowledge would make him feel like a pigmy. However narrow be the field one has chosen, one finds it impossible to encompass and to exhaust it. How then could it be possible to know the whole of science? » Their argument seems peremptory. Yet it is a fallacy based on the assumption that the whole of science is greater than any one of its parts. This is wrong, for when the parts and the whole are infinite, they are of equal size. It is just as difficult to know the history of France, or say the history of Paris, as the history of the world, because both undertakings are equally endless.

It is true that science is becoming more complex every day, but it is also becoming simpler and more harmonious in proportion that synthetic knowledge increases, that is, that more general relations are discovered. It is this very fact which makes encyclopædic efforts still possible. In some respects one might even say that such efforts are easier now than they were before, because the very progress of science enables one to contemplate its development from a higher point of view. The synthetic philosopher who has taken the pains to understand the most difficult parts of science and to climb, so to say, to its summit, enjoys the same advantage as a traveller who can view a whole country from the top of a mountain. No longer do the fantastically shaped hills, the crooked valleys, the deep and mysterious forests delude him; he sees them all from above in their correct relations. Of course he does not know every plant of every nook as does the plant-hunter, nor every insect as the zoologist, nor every stone of the rocks as the prospector. His knowledge is different. This suggests another reason for the possibility of encyclopædic knowledge. Such knowledge indeed is not necessarily vaster than any specialized knowledge, because he who undertakes to master it does not attempt to know, or at least to store in his memory, facts of the same kind. Many of the generalizations which the special investigator has reached at the cost of enormous pains are only elementary facts to the encyclopædist. It is easy enough for the map-maker to draw on his map a new river, to discover the true course of which many men have spent their lives; it is not more difficult for the encyclopædist to register new scientific facts and ideas, each of which is the fruit of considerable ingenuity and endless toil.

Yet most men prefer to stand on the solid ground of immediate experience. Their habits of work increase their timidity, and before long the most circumspect endeavors to organize empirical knowledge seem to them adventurous. It is perhaps chiefly as a contrast with this timidity that undertakings like SPENCER's take heroic proportions.

There *is* a touch of heroism in them, because there is indeed a touch of adventure. Special research is generally less disappointing, for it brings immediate results and moral comfort. The astronomer who sets our clocks right and the chemist who prepares our dyes are just as conscious of their usefulness as the baker is; no doubts will prey on their minds. Again, to put neatly written cards in a drawer, or to classify endless rows of insects or shells, and then to write long

memoirs in which every one of them is fastidiously described, will bring peace and happiness to many people. They well know that they are working for eternity, because it is they who bring together the materials of which any scientific synthesis is made. In the course of time many an edifice will be built with these materials; the buildings will pass, the materials will remain. Most scientists do not go beyond this; they prepare and collect material; they do not build. I suppose they obey a true instinct. They are quickly troubled with giddiness. They are right in refusing to go farther; they are wrong when they say that everybody is dizzy when they are.

The proof that synthetic studies are not necessarily more difficult than others, for one who has the proper constitution, is that SPENCER, whose systematic training was so poor and who could not work more than two or three hours a day, succeeded so well. He succeeded because of the synthetic power of his mind, but also because of his indomitable will, of his tenacity, of his faith.

And SPENCER's relative success gives one much hope, for it is easy to conceive a man having his synthetic grasp, his faith, and far more systematic knowledge and physical endurance. One has only to think of a SPENCER endowed with a greater reserve of health and a competence which would have enabled him in his youth to pursue long university studies and to master the rudiments and the technique of many sciences. One may object that SPENCER's audacity was partly the result of his ignorance. That is plausible. Ignorance has been more than once a source of inspiration; on the other hand, knowledge is always a heavy burden to bear. Many are so overburdened that they can hardly move. But again we may conceive a man strong enough to accumulate a great deal of experience, and yet to remain imaginative and young and keep a clear vision of his purpose.

In this centenary of SPENCER's birthday, let us think of him with gratefulness, not so much for the knowledge which he added to ours, as for the example of moral courage and of faith which he gave us. He helped us to understand the nature and the desirability of synthetic science, to realize its possibility and to keep alive the need and the love of it.

As long as there are men who care not simply for material results, but yearn for unified and harmonious knowledge, the memory of HERBERT SPENCER will be revered.

GEORGE SARTON.

Washington D. C, March 1920.

BIBLIOGRAPHICAL AND ICONOGRAPHICAL NOTES.

1. The present essay on SPENCER has been reprinted from *Scribner's Magazine*, June 1920, as an editorial of *Isis*, for two reasons : in the first place to commemorate the centenary of his birth ; in the second place to emphasize the necessity and the possibility of synthetic knowledge. The second reason is of especial importance because I believe that knowledge limited to the present, without historical background, can not be really synthetic. Such static knowledge can but be superficial ; precious as it may be for practical and material purposes it is philosophically worthless. On the other hand, historical research conducted without any regard to synthetic knowledge, without any interest in the growth of modern science, is bound to degenerate into mere antiquarianism.

2. SPENCER's *main publications*. His first paper « Crystallization », appeared in 1836 in the *Bath and West of England Magazine* for January. His eleventh publication was the first of importance, namely letters « on the proper sphere of government » which appeared in the *Nonconformist* from June to December 1842.

1851. *Social statics or the conditions essential to human happiness specified and the first of them developed*. London, CHAPMAN. This was SPENCER's first book. The Preface is dated December 1850 and the book appeared early in 1851. An abridged and revised edition of it appeared in 1892 together with a reprint of « Man *versus* the State ».

1852. The Development Hypothesis. *Leader*, March 20 (*Essays*, I, 1).

1855. *Principles of Psychology* (in one vol.).

1858. *Essays* (first series).

1860. *A System of Philosophy*. Prospectus distributed in March 1860 by the publisher GEORGE MANWARING, London, giving the programme of the synthetic philosophy, that is the programme of SPENCER's life for the next forty years. Reproduced in the preface to the First Principles, also in the Autobiography II, 557-563.

1860-1862. *First Principles*. First part of the Synthetic philosophy. Issued in six numbers from October 1860 to June 1862. The annual subscription (4 parts) was 10 shillings. There is a copy of this edition in the Harvard Library, with the original blue covers. The four first parts were published by MANWARING, the two last and the complete book by WILLIAMS and NORGATE, London (1). The title page of the whole book is dated 1862, and the preface containing the programme is dated London, June 5th 1862.

(1) WILLIAMS and NORGATE have been the publishers of almost all of SPENCER's books ; the American publishers being D. APPLETON & Co., New York.

Sixth and final ed. of First Principles, 1900.

1861. *Education: intellectual, moral and physical.* London. MANWARING. Collection of four essays published from 1854 to 1859.

1863. *Essays* (second series.)

1864-1867. *Principles of Biology* (2 vol.). Revised ed., 1898-1899. Second part of the synthetic philosophy.

1870-1872. *Principles of Psychology* (2 vol.). Third part of the synthetic philosophy. This is a second ed. of the work in one vol. published in 1855. Fourth ed., 1899.

1873. *The Study of Sociology.* (International Scientific Series.) London, PAUL.

1873- . *Descriptive Sociology*, or groups of sociological facts classified and arranged by HERBERT SPENCER. Compiled and abstracted by DAVID DUNCAN, RICHARD SCHEPPIG, JAMES COLLIER. Eight of these enormous volumes (royal folio) appeared during SPENCER's lifetime (1873-1881). Two more have appeared in 1910, published at the cost of SPENCER's estate and edited by H. R. TEDDER: IX. Chinese by E. T. C. WERNER and X. Greeks, Hellenic Era by J. P. MAHAFFY and W. A. GOLIGHER; others are in preparation. It is doubtful whether these books compiled upon SPENCER's plans and for his own needs will ever be as useful to other scholars as they would have been to him; it is even doubtful whether their utility will ever be commensurate to their cost in time and money.

1874. *Essays* (third series.)

1876-1896. *Principles of Sociology.* Fourth part of the synthetic philosophy.

1879-1893. *Principles of Ethics.* Fifth part of the synthetic philosophy. This part was started after the fourth one but completed before. The whole system was completed in 1896, but SPENCER then began to prepare new editions of the earlier parts, until 1900.

1884. *The Man versus the State.* Reprinted 1892 with Social Statics.

1897. *Various fragments.*

1902 *Facts and comments.*

A complete list of SPENCER's writings will be found in D. DUNCAN. «Life and Letters of H. SPENCER». London 1908. Appendix *C*. Some of the dates quoted by Duncan are not correct (at least in the American edition, vol. II, p. 366-367).

3. *Main publications about* SPENCER. — The main source of information is SPENCER's *Autobiography* which appeared posthumously in 1904 (2 vol). This is a very minute account of his life up to 1882. SPENCER lived until 1903, but the balance of his life was far less interesting. The biography is completed by DAVID DUNCAN's Life and Letters of HERBERT SPENCER, 1908. (London, METHUEN, 1 vol.; New York, APPLETON, 2 vol.). Additional biographical information will be

found in : JOSIAH ROYCE. H. SPENCER, an estimate and review; together with a chapter of personal reminiscences by JAMES COLLIER New York, FOX, 1904; FREDERIC HARRISON. The HERBERT SPENCER [first] lecture. Oxford, CLARENDON Press, 1905. See also : F. HOWARD COLLINS. An epitome of the synthetic philosophy with a preface by HERBERT SPENCER, New York 1889. The preface is a condensation of Spencerian philosophy in less than two pages. The book is a reduction of the synthetic philosophy, section by section, to one tenth- WILLIAM HENRY HUDSON. An introduction to the philosophy of HERBERT SPENCER, New York 1894; 2d ed. 1900. EDMOND PARISOT. H SPENCER. Choix de textes et étude du système philosophique. Paris [1912], with French bibliography. The latest study of SPENCER's life and work, and perhaps the best one is : HUGH S. R. ELLIOT. HERBERT SPENCER (Makers of the XIXth century). London, CONSTABLE, 1917; also with a bibliography.

4. *Portraits of Spencer.* — The following list is not complete but more than sufficient. The portraits are quoted in chronological order. The A. L. A. Index, Washington 1906, p 1371, refers to many other portraits published in periodicals and illustrated books. Probably most of these portraits would be found to duplicate those enumerated below, but some would be new. Of these, some would be dated, some not. It would be easy to date the undated portraits by comparing them to the dated portraits quoted below.

1839, Ae. 19. Head and shoulder, profile to the left. Sketch. (DUNCAN's Life, I, frontispiece.)

1855, Ae. 35. Seated figure to the knees, facing spectator. From a photograph. (DUNCAN's Life, I, p. 100). Earnest but sad-looking face.

1858, Ae. 38. Bust facing spectator. From a photograph (Autobiography, I, frontispiece). Signed « HERBERT SPENCER when 38 ». Beautiful portrait.

Ab. 1865, Ae. 45. Bust facing spectator, the right hand supporting the head. Very beautiful photograph by JOHN WATKINS (see *World's Work*, 5, p. 3107, 1903). An engraving by GEO. E. PERRINE, New York, was based on this photograph and published in *The Eclectic Magazine of Foreign literature, science and art*, vol. XV, New York, March 1872, as an « embellishment » to an essay on SPENCER by E. L. YOUMANS. This engraving is reproduced in the present number of *Isis*. I have chosen it because it is excellent, little known and represents SPENCER at the most critical and glorious period of his life.

1866, Ae. 46. Head and shoulders, face three quarters to the right. From a photograph (DUNCAN's Life, I, p. 166).

1872, Ae. 52. Painted by JOHN BAGNOLD BURGESS. Seated figure to the knees, body turned to the left, facing spectator. Dimen-

sions : 46 in. by 37 1/2 in. National Portrait Gallery, No. 1358 Bequeathed to it by SPENCER Very beautiful portrait, perhaps the best portrait that we have.

1882, Ae. 62. In 1882, SPENCER made a visit to America and of course was photographed on that occasion. I have before me two photographs of that time, both from the E. J. WENDELL bequest, HARVARD Library : 1. by JOHN BEARDSHAW, New York. Bust, face three quarters to the left; 2. by W. G. MARTIN, Montreal. Head and shoulders, facing spectator. A third photograph from the same collection made by ELLIOTT and FRY, London; bust, face three quarters to the left, is a little posterior.

1884, Ae. 64. Photograph by BARRAUDS. Bust facing spectator. (*World's Work*, V, p. 3107, 1903.)

1893, Ae. 73. Bust facing spectator. Hair and whiskers white. Photograph (DUNCAN, II, frontispiece). Beautiful portrait often reproduced.

1898, Ae. 78. From a painting by Sir HUBERT VON HERKOMER (DUNCAN, II, 112). Bust, face three quarters to the right. DUNCAN relates the history of this portrait made after the completion of the synthetic philosophy. (DUNCAN, II, ch. 24.)

Idem. Bust facing spectator. Photograph signed « HERBERT SPENCER when 78 ». Very good portrait. SPENCER is now an old man, yet vigorous.

1901, Ae. 81. Two very good photographs in *World's Work*, 5, p 3109 and 3110. New York 1903 : 1. Seated, to the waist, face three quarters to the right, reading; 2. Seated, full length, at home (Brighton) overlooking the sea. Both photographs copyrighted by ERNEST H. MILLS, London.

There is also at the National Portrait Gallery (No. 1359) a marble bust by Sir JOSEPH EDGARD BŒHM, bequathed by SPENCER. I have not seen it and hence cannot date it.

Cambridge, Mass. Sept. 1920. G. S.

Gaston Milhaud

L'une des pertes les plus déplorables de la période de guerre est celle de Gaston Milhaud. Professeur de philosophie à la Faculté des lettres de Montpellier, puis à la Sorbonne, G. Milhaud fut d'abord un « scientifique ». Son cas est remarquable. S'il n'est pas rare en France de trouver réunies la culture scientifique et la culture littéraire, il est tout à fait exceptionnel de franchir, comme il l'a fait, la cloison administrative qui sépare, dans l'Université, les sciences des lettres. Reçu à l'Ecole Polytechnique et à l'Ecole Normale, section des sciences, en 1878, il opta pour l'Ecole Normale, en sortit agrégé de mathématiques, fut professeur de mathématiques spéciales au lycée du Havre, puis à celui de Montpellier. Son premier ouvrage est une traduction (1) de la *Théorie générale des fonctions* de Paul du Bois-Reymond. Mais il fut de bonne heure attiré par l'histoire des mathématiques et les questions philosophiques qui concernent leurs principes, leur valeur, leurs limites. Il se prit de passion pour les travaux de Paul Tannery, dont il se fit le disciple et le continuateur, et publia en 1893 ses remarquables *Leçons sur les origines de la science grecque*. L'année suivante, il prenait le grade de docteur ès lettres avec une thèse peu volumineuse, mais substantielle : *Sur les conditions et les limites de la certitude logique*, qui eut une deuxième édition en 1898. Peu après, de la chaire de mathématiques spéciales du lycée il passait à la chaire de philosophie de la Faculté des lettres de Montpellier. Il faut dire que ce mathématicien était en même temps bon latiniste et bon helléniste. Il avait écrit une thèse en latin (2), encore exigée à cette époque pour le doctorat ès lettres, et maniait les textes grecs avec la même aisance qu'un pur « littéraire ». Mais aucun grade, titre ni diplôme n'en faisait foi.

(1) En collaboration avec A. Girot, Paris, Hermann, 1887.

(2) *Num Cartesii methodus tantum valeat in suo opere illustrando quantum ipse senserit*, Montpellier, Coulet, 1894.

Appelé à la Sorbonne en 1905, il hésita beaucoup à quitter Montpellier, les amitiés qu'il y avait contractées, et cet *Enclos Laffoux*, sorte de cité verdoyante habitée par des familles d'universitaires qu'unissait la plus charmante intimité. Il finit par se laisser tenter et, comme il était dévoué corps et âme à son enseignement, ses amis purent constater l'envahissement progressif de ce surmenage professionnel auquel il a succombé.

***

L'œuvre de G. Milhaud, faite de petits écrits, séries de leçons, articles publiés ensuite en volumes, et d'un seul ouvrage étendu, les *Philosophes Géomètres de la Grèce* (1900), comporte deux sortes de travaux. Les uns traitent des points d'histoire, les autres se rapportent à la nature et à la valeur de la connaissance scientifique. Les points d'histoire qu'il a élucidés sont de ceux que les historiens de Platon, de Descartes, de Leibniz n'avaient pu résoudre faute d'être assez bons mathématiciens. Il semble bien avoir démontré définitivement que Descartes a découvert la loi des sinus par ses propres recherches, dès 1620, sans connaître ni les leçons ni les écrits de Snellius, et qu'il l'a découverte par une sorte d'intuition de génie dont ne peuvent rendre compte ni la très mauvaise démonstration géométrique qu'il en a donnée, ni l'unique et insuffisante vérification expérimentale du verre parabolique qu'il fit tailler et qu'il décrit dans sa *Dioptrique* (1). Egalement définitive semble cette étude où il montre avec une admirable sagacité en quoi consiste l'originalité de Descartes dans l'invention de la Géométrie analytique. Car Fermat était certainement en possession de cette méthode quand parut la *Géométrie* de Descartes; et cependant ni Fermat, ni aucun contemporain ne semble avoir eu seulement l'idée de soulever une question de priorité. C'est que ni pour Fermat ni pour Descartes la méthode n'était vraiment nouvelle : la géométrie analytique n'était, pour l'un comme pour l'autre, que « l'Analyse des Anciens », perfectionnée, développée, enrichie d'une notation infiniment supérieure ; mais à cet égard le progrès avait été commencé dès le XVI^e^ siècle, notamment par Viète (2). Quant à

(1) « Descartes et la loi des sinus », *Revue générale des sciences*, 1907, reproduit dans *Nouvelles études sur l'histoire de la pensée scientifique*, 1911. — Note sur Descartes, publiée par la *Revue de métaphysique* en 1918.

(2) « Descartes et la géométrie analytique », *Revue générale des sciences*, 1906 reproduit dans le même volume de 1911.

l'*Inventum mirabile* que DESCARTES signale dans la note marginale des *Olympia* à la date du 11 novembre 1620, ce n'est pas, comme plusieurs l'ont cru, la géométrie analytique, mais la loi des sinus, c'est la théorie mathématique qui permet de construire des lunettes pour observer les astres (1). Citons encore, parmi les travaux historiques, le différend entre les cartésiens et LEIBNIZ, entre les cartésiens et NEWTON, relativement au principe de la conservation du mouvement (2), et la question si obscure de l'*Apport de l'Orient et de l'Egypte dans la science grecque* (3).

* * *

Les écrits théoriques de MILHAUD sont presque tous consacrés à mettre en lumière et à saisir sous de multiples aspects la spontanéité inventive de la raison, son pouvoir et son droit de création libre. Sans doute le physicien ne dispose pas des faits, pas plus que le mathématicien ne se permet de changer les données du problème qu'il a entrepris de résoudre. Sans doute, l'un et l'autre soumettent toutes les démarches de leur pensée à des règles rigoureuses. Mais ni les faits ni les règles logiques ne sont pour eux des obstacles, des entraves ou des lisières; ils sont bien plutôt des leviers, des outils, — outils déjà construits par l'intelligence, pour son propre usage, et dont elle se sert ensuite pour construire d'autres connaissances, créer des vérités. Même les empiristes, même les positivistes, qui prêchent une soumission docile et quasi passive aux faits, une défiance timorée à l'égard des anticipations aventureuses, ne parviennent jamais à faire de l'intelligence un miroir de la nature et de la science un simple enregistrement des faits. Ce n'est pas par l'intuition, et en épousant d'aussi près que possible les contours du donné empirique que la pensée assure son succès et son progrès, c'est au contraire par l'abstraction qui élimine de l'image tout ce qui conserve encore quelque qualité concrète et sensible. Par une transformation continue, l'esprit substitue aux données intuitives des êtres de raison qu'il domine et qu'il manie, et s'éloigne du réel pour atteindre le vrai.

Il y a donc contraste parfait entre le rationalisme de MILHAUD et

(1) *Revue de métaphysique*, 1918.

(2) « LEIBNIZ et les lois du mouvement », *Revue philosophique*, 1900. — « DESCARTES et NEWTON », *Revue de métaphysique*, 1908. Ces deux articles reproduits dans, *Nouvelles études sur l'histoire de la pensée scientifique*, 1911.

(3) *Revue générale des sciences*, juin 1910, reproduit dans le même recueil.

l'intuitionnisme de Bergson. Cherchons avant tout le réel, dit celui-ci, et pour cela « tournons le dos à la science » qui nous en éloigne. Tâchons de retrouver la donnée immédiate, l'intuition primitive dans sa pureté, telle qu'elle était avant d'être déformée par la raison. Cherchons avant tout l'intelligible, dit l'autre, et pour cela élaborons, transformons nos concepts, assouplissons-les, épurons-les, dégageons-les de tous les éléments qualitatifs et intensifs qui trahissent leur origine intuitive; faisons-en ces concepts rationnels, ces purs « êtres de raison » qui seuls peuvent rendre l'intuition intelligible, qui sont même nécessaires pour la rendre seulement saisissable, et qui peuvent aller jusqu'à permettre de l'anticiper.

La science n'est certes pas fiction, mais elle est invention; elle n'est pas arbitraire, mais elle est œuvre de liberté. En ce sens, elle est une manière de poésie. En ces pages, écrites avec tant de charme, où Milhaud révèle, décrit, admire l'activité créatrice de la pensée raisonnante, on sent une sorte d'ivresse poétique, d'enthousiasme dionysien; lui-même va jusqu'à employer les mots de « vertige » et même de « miracle » (1).

Mais nul n'a connu mieux que lui les dangers de ce vertige. Il aimait à étudier l'influence des études mathématiques sur la pensée philosophique. C'est surtout dans la mathématique que la pensée devance la nature, sans aucun scrupule d'ailleurs, et de plein droit, puisque cette science n'a pas pour objet le réel. Elle est sûre qu'elle finira par le rejoindre : la science pure deviendra science appliquée s'il se présente des cas auxquels elle soit applicable. Mais le mathématicien est enclin à garder la même hardiesse en métaphysique, en morale, en politique. Il est volontiers dogmatique; il l'est jusqu'au pire excès; il irait jusqu'à confier au savant une autorité sociale et politique illimitée. Il commande et condamne au nom de la raison avec la même assurance que l'inquisiteur au nom de Dieu : l'absolu est intransigeant. En outre, le mathématicien est naturellement porté à être idéaliste. L'idée, d'autant plus intelligible qu'elle est plus abs-

(1) Il était naturel que Milhaud fût conduit à des idées très voisines de celles que j'ai exposées dans mon *Traité de logique* sur le raisonnement déductif. Je ne sais comment son article sur « Le Raisonnement géométrique et le Syllogisme » (reproduit dans *Le Rationnel*, 1898) a pu m'échapper, ni par quel excès de scrupule lui-même ne m'y a pas renvoyé. Dans cet article très pénétrant, on croirait à chaque instant qu'il va faire le pas décisif. Il ne le fait pas; il ne songe pas à rompre avec la tradition scolastique d'après laquelle le raisonnement, c'est le syllogisme.

traite, plus pure, plus dégagée de tout élément empirique, lui paraît plus importante, plus saisissable, plus solide, plus réelle que le sensible. Dans les *Philosophes-Géomètres de la Grèce* (1900), son ouvrage le plus étendu, où il est à la fois historien et logicien, MILHAUD a montré, plus particulièrement chez PLATON, ces deux excès comme des conséquences de la culture géométrique. Ailleurs, il les relève dans AUGUSTE COMTE, auquel il a consacré un volume (1). Il les a signalés, il en eût peut-être donné une étude approfondie, dans DESCARTES, MALEBRANCHE, LEIBNIZ, RENOUVIER.

Il est mort à 60 ans. Sûrement il n'avait pas achevé son œuvre. Faut-il le ranger parmi les victimes de la guerre? Peut-être. A vrai dire, sa santé était depuis longtemps mauvaise. En 1913, après avoir corrigé avec moi, au prix d'un effort inouï et sans doute imprudent, l'une des compositions écrites de l'agrégation de philosophie, il lui fut impossible de siéger aux épreuves orales. Mais il ne s'agissait que de surmenage; un séjour à la montagne lui avait rendu assez de force pour reprendre ses cours. Les angoisses de la guerre, angoisses patriotiques, angoisses paternelles, contribuèrent certainement à hâter sa fin.

EDMOND GOBLOT.

---

(1) *Le positivisme et le progrès de l'esprit*, 1902.

Two Twelfth Century Algorisms

The Latin treatises on the Hindu art of reckoning which antedate the XIV^th century are sufficiently rare so that the addition even of anonymous works to the available literature on this subject is highly desirable. Doubtless the earliest of these algorisms are the two ascribed to AL-KHOWARIZMI, published by BONCOMPAGNI (1), the first a translation and the second probably an adaptation of the Arab's lost work on arithmetic. Of the XII^th century also are the fragments on multiplication and division by N. OCREAT (O'CREAT) (2), and the algorism published by NAGL (3) and again by CURTZE (4). Of the algorisms of the XIII^th century the three most widely used were the *Carmen de algorismo* (5) by ALEXANDER DE VILLA DEI, SACROBOSCO's *Algorismus vulgaris* (6), and LEONARD OF PISA's *Liber abaci* (7). The *Algorithmus demonstratus* of GERNARDUS (8), and the treatises ascribed to JORDANUS NEMORARIUS (9), all of the XIII^th century, were not widely

---

(1) *Trattati d'arithmetica* : I. « Algorithmi de numero indorum » and II. « Liber Algorismi de pratica arismetrice », Rome, 1857.

(2) *Abhandl. zur Gesch. d. mathem. Wiss.*, 3, p. 129-139 (M. CHARLES HENRY), 1880.

(3) *Zeitschrift für Math. and Physik*, vol. 34 ; *Hist. litt. abth.*, p. 129-146, 161-170.

(4) *Abhandl. zur Gesch. d. mathem. Wiss.*, 8, p. 1-27.

(5) HALLIWELL, *Rara mathematica*, p. 73-83, London, 1839.

(6) CURTZE, published with the commentary by PETRUS DE DACIA, Copenhagen, 1897.

(7) BONCOMPAGNI, *Scritti di Leonardo Pisano* : I. « Il liber abbaci » Rome, 1857.

(8) Nuremberg, 1534, and ENESTRÖM, « Der Algorismus de integris des Meisters GERNARDUS » ; *Biblioth. Mathem*, t. 13, p. 289-332, 1912-1913.

(9) ENESTRÖM, « Ueber eine dem JORDANUS NEMORARIUS zugeschriebene kurze Algorismusschrift » ; *Biblioth. Mathem*, t. 8, p. 135-153, 1907-1908. ENESTRÖM, « Ueber die *Demonstratio* JORDANI *de Algorismo* », *Biblioth Mathem*, t. 7, 1906-1907.

used; the Euclidean form of demonstration employed places these works in a class by themselves. Related to the *Carmen* and to SACROBOSCO's work are the two algorisms, in French (1) and Icelandic (2), both of the XIII^th century. Mention should also be made of the algorisms of the same century, probably, published by CANTOR (3), and by GERHARDT (4), and possibly also the commentary on SACROBOSCO by PETRUS DE DACIA (5).

The algorisms which are here presented bear internal and external evidence that they date from the XII^th century. Possibly we should refer to one algorism rather than to two (or three) since the differences in terminology and methods are so slight that a common source, at least, can hardly be denied. The algorisms in question are both found in the British Museum (6), the one in Royal MS. 15 B. IX, f. 77^b (7), and the other in EGERTON MS. 2261, f. 225^b-227^b (8). The first manuscript is ascribed by the experts of the British Museum to the end of the XII^th century or to the beginning of the XIII^th; a XV^th century copy of the algorism in the EGERTON manuscript is found in Paris, MS. Latin, 10252, fol. 68*a*-70*b*. The Royal manuscript, once the property of the mathematician JOHN DEE, employs numeral forms and terminology, as well as handwriting indicative of a treatise of the XII^th or early XIII^th century. The EGERTON MS. has at

---

(1) V. MORTET, *Biblioth. Mathem.* 9, p. 55-64.

(2) Published by FINNUR JONSSON, in *Hauksbók*, p. 417-424, Copenhagen, 1892-1896.

(3) Program, Salzwedel, 1853.

(4) *Zeitschrift für Mathem.*, 10, p. 1-16, 1865.

(5) CURTZE, *loc. cit.*

(6) My attention was called to these manuscripts by the reference to them in the article, « On the Early Use of Arabic Numerals in Europe », by G. F. HILL, *Archaeologia*, vol. 62, p. 137-190, London, 1910. Subsequently, I found that reference to the algorism in Royal MS. 15 B. IX is made by BUBNOV, GERBERTI *postea* SILVESTRI II, *papae Opera Mathematica*, p. XXXVIII, Berlin, 1899.

(7) HILL, *loc. cit.*, places this early in the XIII^th century and adds that some authorities date it as early as the XII^th. BUBNOV, *loc. cit.*, places the rest of the manuscript in the XI^th century and this as somewhat questionably of the XII^th. Elsewhere in the same work BUBNOV dates this manuscript as of the XI^th or early XII^th century. The contents as given by BUBNOV include BOETHIUS *Musica Institutio*, various letters and treatises relating to GERBERT, and works on the astrolabe (GERBERT, HERMANN, and anonymous from the Arabic), geometry, computus and allied subjects.

(8) HILL, *loc. cit.*, dates this c. 1230-1250, and calls it of English origin.

the top and bottom of each page, the decorative flourishes which are said to be characteristic of English writing of the early XIII^th century.

Particularly noteworthy is the use in both versions, of the words *procedere* (*procedendi*) for numeration, and *puncta* (1) for minutes, both of which are designations not found in other algorisms. The use of the word *karacteres* in the Royal manuscript is significant for this is found only in the first of the *Trattati*, of the algorisms which we have mentioned,and aside from that only in the works (2) of the X^th to XII^th centuries dealing with the abacus.

TRANSLATION OF THE ALGORISM

(Following the Royal Manuscript; numerical illustrations added by the author of the present article).

« The intention of AL-KHOWARIZMI in this work is to present the teaching of numeration, addition, subtraction, duplication and mediation, multiplication, and division by the ten characters of the Hindus. The knowledge of these is useful. Observe that they wrote the characters from right to left, while we write them in the reverse direction.

« Zero, nine, eight, seven, six, five, 0, 9, 8, 7, 6, 5, four, three, two, one, which are equal in order to 4, 3, 2, 1. And first it is necessary to recognize (the terms) *places* places and orders. We call the spaces in which the characters are written; orders, in truth, the numbers from one to ten, from ten to one hundred, from one hundred to one thousand, from one thousand to ten thousand, from ten thousand to one hundred thousand, from one hundred thousand to one thousand thousand, from one thousand thousand to ten thousand

---

(1) This designation for minutes is found in the treatise of 1120 on astronomy by WALCHER, prior of Malvern; his work was based on that of one PETRUS ANFUSI, or ALPHONSI, a Jewish astronomer of the early XII^th century. See HASKINS, « The reception of Arabic Science in England », *English Historical Review*, vol. 30, p. 56-69, 1915.

(2) P. TREUTLEIN, « Intorno ad alcuni scritti inediti relativi al calcolo dell' abaco », in *Bullettino di bibliografia e di storia della scienze matematiche e fisiche* ; X, p. 589-647; the word appears in four of the treatises. Similarly in the work by RADULPH of Laon (*Abhandl, zur Gesch. d. Math. Wiss.* 5), in the abacus interpolated in the geometry of BOETHIUS (BUBNOV, p. 158); in RICHER, *Historiarum* 54, (BUBNOV, p. 380-381), this word is used.

thousand, from ten thousand thousand to one hundred thousand thousand, from one hundred thousand thousand to one thousand thousand thousand. Thus with these the progression of places and orders is by tens, changing each figure to different places constitutes different orders by tens.

« If you wish to add a number to a number, place the greater number according to its orders, and the lesser under it by its, in such a way that the first (*i. e.*, the units) of the lesser is under the first of the greater, and the second under the second. Add the first of the lesser to the first of the greater and that which results, if it is below ten, write in the place of the first of the greater. If it results in ten, write in the place of the first of the greater the figure Θ, that is nothing, and of the ten make one in the preceding (place). If it results in more than ten, that which is above ten write in the place of the upper and of the ten make one in the preceding (place). Similarly, add the second to the second and proceed in the same manner; also proceed in the same way if there are more. »

Numerical illustration, 826 *plus* 483.

826	829	909	1309
483	48	4	

« If you wish to subtract a number from a number, set down the larger number according to its places and the lesser under it according to its (places) so that the first (place) is under the first, and likewise for the rest. Then subtract the first of the lesser from the first of the greater and if there then be a remainder write it in the place of the first of the larger. If the parts are equal write in the place of the first of the larger the figure for naught, that is Θ. If indeed the first of the lesser number is greater than the first place of the larger take one from the second place of the larger number which is worth ten in the first and from that ten and from the number of the first place of the larger subtract the first of the lesser and the remainder write in the place of the first of the larger. Similarly treat the second and the rest. »

The several stages in the process of subtraction of 124 from 329, and 139 from 365 are here graphically indicated :

329	325	305	205
124	12	1	
365	356	326	226
139	13	1	

« If you wish to double any number place it according to its places. Then begin to double at the last place, lest if you should begin at the first you would double the same number twice. If that which results from the doubling is below ten write it in the place of the last (digit); if it is just ten write in the place of the last (digit) the figure for naught, Θ, and of ten make one beyond. If there results (a number) greater than ten, write what is greater than ten in the place of the last (digit) and of ten make one in the place before. Similarly treat the rest up to the first (place). »

Graphical illustration : 2 x 367 :

367; 667; 727; 734.

« If you wish to halve any number, set it down according to its places (orders of digits). Then halve the first place and, if the number is even, write the half in the place of the first; if it is odd, write half of the even number in the place of the first order and the unit which remains is worth 60 (points) and by points divide it into two (equal parts) and the half, that is xxx, write under the first place, writing the figure for naught and the figure for three. Then halve the second and write the half, if it is even, in the place of the second order. If it is odd, write half of the even (number) there and halve the one which remains which is worth ten in the first place, and then write the half, *i. e.*, five, with the number which is in the first place. »

Graphical illustration of 785 ÷ 2 :

785; 782_{30}; 742_{30}; 392_{30}.

« If you wish to multiply a number by another, place the number which you wish to multiply according to its orders and the number by which you wish to multiply by its, in such a way that the first of that by which you wish to multiply is under the last of that which you wish to multiply. Then multiply the last by the last, and that which results from that multiplication write in the place of that by which you multiply. If indeed it results in ten, write above it the figure for naught and of ten make one in the preceding (place). But if it results in more than ten, that which is above ten write there and of the ten make one in the preceding place. If moreover it results in twenty or in more, if there is nothing over tens, write above the last figure a naught and the tens write in the preceding (place). If there is something in addition to the tens (*i. e.*, units), write it above the last and the tens beyond. Then multiply the same by the penultimate and that which results from this multiplication if it is below ten write

above the penultimate of that by which you multiply. If indeed in ten or above, treat it like the last (figure) and so multiply the last by each one up to the first. »

« When now you multiply the last by the first, delete the last and write the product, if it is below ten, there; if it is ten or above treat it as indicated for the rest. Then draw back the digits of that by which you multiply in such a way that the first digit of it is under the penultimate of that which you multiply, and multiply that penultimate by each figure of that by which you are multiplying, as has been indicated, up to the first. Then again delete that penultimate and so multiply each digit of that which you multiply by each of that by which you multiply. And note that if the figure naught is included in the number which you multiply you omit it, since it can not be multiplied, but it is not deleted. »

Graphical illustration : 324×264 :

324	6 324	78324	79234
264	264	264	264

Up to this point 264 has been multiplied by 3 (300), from left to right, and the partial product, 792, appears in the upper line, followed by the 24 or the remaining two digits of the 324; the 264 is now moved one place to the right and the multiplication is continued by the upper 2, of the 24, adding in the partial products as they occur.

79224	83224	84424	84484
264	264	264	264

As this point the 264 has been multiplied by 2 (20), from left to right, and the partial product, 528, has been added in three successive stages to the first partial product 792, *i. e.*, 79200 has been added to 5280, giving 84480; the sum 8448 appears in the upper line followed by the final 4 of 324; 264 is again moved one place to the right and the multiplication by the final 4 follows, adding to 8448 the three portions of the partial product as they occur.

84484	85284	85524	85536	85536, product.
264	264	264	264	

« If you wish to divide a number by another number, place according to its orders the larger number which you wish to divide and the lesser by its orders, in such a way that the last of the lesser is under the last of the greater, and, if there are more, the penultimate under the penultimate and so in order. Then consider how many

times the last digit of the lesser is contained in the last digit of the greater and consider if the others are contained as many times in the remaining digits. Starting at the last subtract the last that many times from the last of that which is above it, and from all of the others up to the first of the lesser. Write the number representing how many times in a line with the first of the lesser number above the greater number. Then draw back the divisor under the penultimate of the larger and consider how many times the last of the lesser is contained in the penultimate of the larger and consider whether the remainder is contained in the remaining (digits) as many times. But if you are not able to place the last of the lesser under the penultimate, if perchance nothing remains of it, after the first estimate place it under the following and consider how many times it will go into that and the rest into the remaining; and write the number denoting the quotient above the first of the lesser; and if any space is vacant between the first which you wrote and this write the figure for naught and so if there are more spaces vacant. Proceed in this manner until you can no longer divide the superior number. The end. »

Graphical illustration : 85536 ÷ 264 :

	3	3	3	3
85536	85536	25536	7536	6336
264	264	264	264	264

Up to this point the successive portions, 6, 18 and 12, or 60000, 18000 and 1200, of the partial product of 300 times 264, have been subtracted as they occur from the dividend, leaving 6336 as remainder; then the divisor 264 is moved one space to the right and the division continues.

3	32	32	32	32
6336	6336	2336	1136	1056
264	264	264	264	264

At this point, after having obtained by inspection 2 as the next figure in the quotient, the 1056 is the remainder after 2 (or 20) times 264 has been subtracted in successive stages from 6336.

32	324	324	324	324	324, quotient.
1056	1056	256	16		
264	264	264	264	264	

TEXTS

Royal MS. 15, V. IX, fol. 77b, British Museum.

Intencio algarismi est in hoc opere doctrinam prestare procedendi, addendi, minuendi, duplandi, et mediandi, multiplicandi, et diuidendi per X karacteres indorum. Utilitas est cognitio eorundem. Ecce karacteres scripsit a dextra in sinistrum cum nos scribamus e conuerso. Nichil, novem, octo, septem, setiam, quinarii, 0, 9, 8, 7, 6, 5 (2), quater, ternia, bina, unitas, his premissis singula exequantia, 4, 3, 2, 1. Et primus quod uidendere oportet prenoscere loca et differentias. Loca appelleramus spacia in quibus scribantur karacteres. Differentias uero numerus ab unitate ad decem, a decem ad *c*, a *c* ad *m*, a *m* ad *xm*, a *xm* ad *cm*, a *cm* ad *M. Milia*, a *m. Milibus* ad *xm milia*, a *xm milibus* ad *cm* (*sic*), a *cm* milibus ad *c* (Mille *in ras.*) *M. milia*, a *cm milibus* ad *mille M. milia*. Sic de istis per decennarium processio est locorum et differentiarum, mutato vnaqueque figura per diuersa loca diuersas

Egerton MS. 2261, fol. 225b-227b British Museum (B). MS. Latin, 10252, fol. 66a-70b, Paris, Bibl. Nat. (P).

TRACTATUS ALGORISMI: ET DE SEPTEM EIUS SPECIEBUS (*tit. om.* B).

Intendit algorismus in hoc opere primum docere procedere, addere, duplicare (dupplare P), mediare, multiplicare, diuidere, per IX figuras yndorum que sunt (fiunt P) huiusmodi (hoc modo P), Θ (*sup. ver.* B), 9, 8, 7, 6, 5, 4, 3, 2, 1 (1).

De processu seu numeratione (*tit. om.* B).

Procedere igitur est cognoscere quem numerum unaqueque figura notet per singula loca. Primo enim loco quelibet figura posita unitatem uel unitates notat. Secundo loco (+ decem uel. P) decena. Tercio centum uel centena. Quarto (*om.* centum..... Quarto B) millena (Mille uel millena P), et sicut usque ad infinitum. Verbi gratia, hec figura, 1, primo loco posita (*om.* P) unitatem significat. Secundo X, tercio centum, quarto mille et (+ sic P) de (in P) ceteris. Similiter hec figura 2 in (om. P) primo loco posita duas unitates significat (notat P), in secundo XX, in

(1) For numeral forms, see G. F. HILL, *loc. cit.* Table III, Row 2.

(2) For the forms of the numerals, see the article by G. F. HILL, *loc. cit.* Table IV, Row 2.

constituit differentias per decennarium.

tercio CC, (+ in quarto duo milia P), et sic in ceteris. Hec figura (+ etiam P) 3 primo loco posita tres unitates significat (designat P), in secundo XXX. In tercio CCC (+ in quarto tria milia P) et sic in ceteris (+ fiet P). Notandum autem quod ita figuras disponimus scribendo ut a dextra incipiamus (+ et P) in sinistram ordinemus figuras. Ita quod secundum locus precedenti sit decuplus. Nunc autem (vero P), ad dandas artis regulas accedamus.

De Additione.

Si uis addere numerum cum numero pone majorem numerum per suas differentias et minorem sub eo per suas. Ita quod prima minoris sit sub prima maioris et secunda sub secunda(1) prime maioris. Si uero in decem excreuerit scribe in loco prime maioris figuram Θ, id est nichil, et de decem fac unum in antea. Si autem ultra decem excreuerit quod ultra decem fuerit scribe in loco prime maioris et de decem fac unum in antea. Similiter adde secundam secunde et fac similiter et si plures fuerint eodem modo.

Si uolueris numerum numero addere scribe maiorem numerum per suas differentias et minorem sub eo per suas quem maiori addere uolueris ita quod prima differentia minoris contineatur sub prima maioris. Secunda sub secunda, et sic de ceteris. Notate quod non ideo maior numerus appellatur primum dispositus quia unaqueque figura maioris sit maior unaqueque minoris, sed quare summa tocius numeri inferioris minor debeat esse summa tocius numeri superioris. Deinde adde primam differentiam minoris prime differentie maioris. Et numerum qui inde excreuerit si infra X fuerit ibi scribe. Si uero in

(1) In this paragraph there is a very evident omission in the second sentence before the final words *prime maioris*. Evidently something to this effect : « Adde primam minoris prime maioris et quod inde excreuerit si infra decem fuerit scribe in loco ».

X excreuerit in directo (1) prime maioris scribe figuram nichili Θ et de X fac unam ultra. Si ultra X excreuerit quod super est X scribe super caput addentis et X scribe ut supra diximus (in loco prime maioris et de X fac unum ultra P *pro* super.... diximus). Postea adde secundam secunde, terciam tercie, eodem modo faciendo ut de prima maioris et de prima minoris diximus (+ et de reliquis sic facies P) (2).

De subtractione.

Si uis minuere numerum a numero pone maiorem numerum per suas differentias et minorem sub ea per suas ita quod prima sit sub prima et ita de ceteris. Deinde subtrahe primam minoris a prima maioris et si quod inde residuum fuerit scribe in loco prime maioris. Si uero partes equales fuerint scribe in loco prime maioris figuram nichili, id est Θ. Si uero prima minoris fuerit maior quam prima maioris accipe unum de secunda differentia maioris quod ualet in prima decem et ex illa decem et ex numero prime maioris subtrahe primam minoris et quod residuum fuerit scribe in loco prime maioris. Similiter fac de secunda et de reliquis (3).

Si aliquem numerum ab aliquo numero subtrahere volueris scribe maiorem numerum per suas differentias et minorem sub eo per suas ita quod prima minoris sit sub prima maioris, secundus sub secundus. Deinde subtrahe primam minoris a prima maioris et quod remanserit scribe in loco prime maioris. Si uero prima minoris maior fuerit quam prima maioris accipe unam vnitatem de secunda differentia que ualebit X in prima et de illis X et de numero qui est in loco prime maioris subtrahe primam minoris et quod ibi remanserit scribe. Si autem in secundo loco non erit aliqua figura, summe vnitatem de tercio loco que secundo loco C ualebit de qua novenaruim scribes

(1) Trattati I and Trattati II use « in directo » under division ; Sacrobosco employs « ex directo ».

(2) From this point on only major or noteworthy variations in the manuscripts will be indicated.

(3) *Carmen*, *loc. cit.*, p. 76, « Et sic de reliquis facias, si sint ibi plures ».

in secundo loco et vnitatem transferes in primam que ibi ualebit X. Quibus iunctis numerum subtrahes minoris. Postea secundam de secunda et sic de ceteris.

De duplatione.

Si uolueris aliquem numerum duplicare, scribe illum per suas differentias. Postea incipe duplare ab vltima differentia et si infra X fuerit ibi scribe. Si uero vsque in X excreuerit, in loco vltimo scribe figuram nichili et de X fac unum vltra. Ideo autem ab vltima figura incipere diximus ne si a prima incipiatur idem bis duplicetur.

Si uis duplare numerum aliquem pone eum per suas differentias. Deinde incipe duplare ab ultima differentia ne si a prima incipias eundem numerum bis duples. Quod autem ex duplatione illa excreuerit si infra decem fuerit scribe in loco ultime. Si uero in decem scribe in loco ultime figuram nichili Θ et de decem fac unum ultra. Si autem ultra decem excreuerit quod supra decem fuerit scribe in loco ultime et de decem fac unum in antea. Similiter fac de reliquis usque ad primam.

De mediatione.

Si uolueris aliquem numerum mediare, scribe illum per suas differentias. Postea mediare incipiens a prima differentia et quod residuum fuerit ibi scribe. Si par fuerit numerus medietatem paris. Si uero impar in prima differentia sublatam medietatem paris ibi scribe. Medietatem autem unitatis cuius medietatis sunt XXX puncta notabis per figuram ternarii sub ea positam figuram nichili prepo-

Si uis mediare numerum aliquem (1) pone eum per suas differentias. Deinde media prima differentia et si numerus par fuerit medietatem scribe in loco prime. Si uero impar fuerit medietatem paris scribe in prime differentie loco, et unum autem quod remanet ualet lx et per puncta diuide in duo, et medietatem, id est XXX, scribe sub differentia prima, scribens figuram nichili et figuram

(1) *Carmen*, *loc cit.*, p. 76, « Incipe sic. si vis aliquem numerum mediare ».

ternarii (1). Deinde media secundam et medietatem si par fuerit scribe in loco secunde differentie. Si uero inpar medietatem paris scribe ibi, unum uero quod remanet et ualet decem in prima diuide per medium, et medietatem, id est quinque, scribe cum numero qui est in prima differentia.

Si uis multiplicare unum numerum per alium, pone numerum qui uis multiplicare per suas differentias et numerum per quem uolueris multiplicare per suas. Ita quod prima illius per quem multiplicare uolueris sit sub ultima illius quem multiplicare uolueris. Deinde multiplica ultimam per ultimam et quod ex multiplicatione illa excreuerit si infra decem fuerit scribe in loco illius per quem multiplicas. Si uero in decem excreuerit scribe super eam figuram nichili et de decem fac unum in antea. Si autem ultra decem excreuerit quod ultra decem sita. Constat enim unaqueque vnitas in LX punctis quia possibile est quamlibet in secundos, ternarios diuidi. Amplius, Si in secunda differentia impar fuerit sublata unitate medietatem paris ibi scribe. Vnitatem uero tamen transfer in primam differentiam que ualebit ibi decem quorum medietatem ibi scibes id est quinarium. Similiter de reliquis facies et notate quod a prima differentia incipere debemus mediacionem. Si enim ab vltima inciperemus bis idem fortassis mediaretur.

De multiplicatione.

Si uolueris aliquem numerum multiplicare per alium, scribe maiorem per suas differentias et minorem sub eo per suas. Ita quod prima minoris contineatur sub ultima maioris. Deinde multiplica vltimam differentiam maioris per vltimam minoris et numerum qui inde excreuerit si infra X fuerit in directo vltime minoris scribe et si in X excreuerit super multiplicantem fac figuram nichili et de X unam ultra. Si uero ultra decem illum qui supra decem fuerit in directo illius scribe et de decem unum ultra. Postea multiplica eandem figuram

(1) Trattati I, « Pone sub eadem differentia XXX ».

Trattati II, « Sed medietatem unitatis médiande, que superest, per figuram ternarii, preposito circulo subtus, describe ».

Similarly in the XII^th Century algorism, CURTZE, *loc. cit.*, « Sub eadem differentia 30 ex 60 ponemus ».

fuerit scribe ibi et de decem fac unum in antea. Si uero in duo decena uel in plura excreuerit si nichil ultra decena fuerit scribe super ultimam figuram nichil et decena scribe in antea. Si uero preter decena aliquid fuerit scribe illud super ultimam et decena ultra (1). Deinde multiplica eandem per penultimam et quod ex multiplicatione illa excreuerit si infra decem fuerit scribe super penultimam illius per quem multiplicas. Si uero in x uel ultra fac sicut de ultima et ita multiplica illam ultimam per omnis usque ad primam. Quando autem multiplicas ultimam per primam dele ultimam et multiplicare (*sic*) si infra decem est ibi scribe, si in decem uel ultra fac sicut dicendum est de reliquis. Deinde protrahe figuras illius per quem multiplicas ita quod prima illius sit sub (pen)ultima eius quem multiplicas et multiplicata illam penultimam quilibet (?) qui per omnis figuras illius per quem aliquem (?) multiplicas sicut predictum est usque ad primam et iterum dele illam penultimam et sic multiplica omnis figuras illius quod multiplicas per omnis illius per quem multiplicas. Et nota quod si autem figura nichili inter erit numero quod multiplicas illam intermittes quia non potest multiplicari non tamen delebit. id est vltimam maioris per penultimam minoris eodem modo faciendo vt paulo ante dixi. Et ita facies donec prima maioris eadem vltima minoris multiplicetur. Deinde deleta illa subtrahes figuras ita quod prima minoris contineatur sub penultima maioris que similiter per omnes figuras minoris multiplicentur. Ita faciendo ad primam maioris uenies.

(1) *Carmen, loc. cit.*, p. 77, « Articulus supraposito digito salit ultra ».

De diuisione.

Si uis diuidere numerum per alium numerum pone maiorem numerum quem diuidere uolueris per suas differentias et maiorem (*sic*) per quem diuidere uolueris per suas ita quod ultima minoris sit sub ultima maioris et si plures fuerint penultima sub penultima et sic per ordinem. Deinde considera quociens ultima minoris porerit esse ultima maioris et considera si quociens poterit esse reliqui in reliquis (1). Subtrahe ultimam ab ultima quociens ex illo quod superest a prima (2) et ab omnibus illius qui sunt usque ad primam minoris et numerum notantem tociens scribe in directo prime minoris desuper maiorem numerum. Deinde protrahe, subtrahe (3) penultimam maioris et considera quociens ultima minoris sit in penultima maioris et relique in reliquis tociens esse consideretur. Si autem sub penultima non poterit pone ultima minoris, si forte nichil ex ea remanserit ex prima consideratione pone sub sequenti et considera quociens illa sit in illa et relique in reliquis et numerum notantem tociens scribe super

Si uolueris aliquem numerum per alium diuidere, scribe quem diuidere uolueris per suas differentias et minorem sub ea per suas. Ita quod vltima differencia minoris sit sub vltima maioris. Postea considera quociens vltima minoris contineatur in vltimam maioris et tociens sit penultima minoris in penultimam maioris. Ita dico id est quod omnes differencie minoris equaliter se habent in differentias maioris unaquaque id est in sua supposita et numerum notantem quociens scribe in directo prime minoris. Ita quod singule sub singulis contineantur. Et fac similiter id est consideranda quociens figure minoris comprehendantur in figuris maioris equaliter cum ut dixi. Si uero vltima minoris maior fuerit quod vltima maioris subtrahe figuras minoris ita quod vltima sub penultima contineatur. Postea considera quociens in ultima et penultima maioris ultima minoris fuerit et si totidem fuerint reliqua in reliquis. Numerum notantem quociens scribe vt dixi. Et nota quod minucio probat addicionem et e conuerso. Mediacionem dupli-

(1) N. O'Creat, *loc. cit.*, « maximus a maximo detrahatur quoties poterit, ita tamen ut reliqui a reliquis totiens detrahi possint ».

Sacrobosco, *loc. cit.*, « quotiens illa possit subtrahi a figura sibi supraposita, ita quod totiens possint subtrahi reliquae a sibi suprapositis et a suo residuo... »

(2) Error; should be *ab ultima*.

(3) By error for *sub*.

primam minoris et si aliquod spacium uacuum fuerit inter illam quam primum (?) scripsisti et hanc scribe figuram nichili et sic si plura spacia uacua fuerint et ita procede usque quod numerum superiorem non possis diuidere. Explicit.

cacio et e conuerso. Diuisio multiplicacionem et e conuerso.

At this point the EGERTON manuscript presents a second discussion of numeration, but with no indication in the manuscript that this is not a simple continuation of the preceding work.

« Primus, decenus. Centenus. Millenus. Decenus millenus. Centies milia. Mille milia. Decies mille milia. Centies mille milia. Milies mille milia. Decies milies mille milia. Centies milies mille milia. Milies milies mille milia. Decies milies mille milia et mille milia (*sic*). Centies milies mille milia et mille milia et sic in perpetuum (1).

« Si digitus digitum multiplicat. Vide quanta sit differentia multiplicandi ad denarium et tociens aufer multiplicantem a summa quam reddiderit denarius multiplicatus per eundem (*et cetera*). » (2)

The EGERTON manuscript continues with the six rules for the multiplication of digits, articles, and composites, simular to those given by SACROBOSCO (3) but not in the same order. Somewhat analogous rules for division are also presented. The following passages will indicate the nature of this work.

« Si articulus per articulum fuerit diuidendus subtrahe quociens poteris digitum a digito et tociens continetur articulus in articulo.

« Quociens maior numerus fuerit diuidendus qui ad minorem fuerit multiplex consideretur quociens minor contineatur a maiori et tot integra contingent cuilibet diuisori. Vt si duodenarius ternario fuerit diuidendus. Quare ternarius quater continetur in duodenario, cuilibet diuisori contingent quatuor integra.

« . . . . . .

« Multiplex superparciens dicitur maior ad minorem quociens maior

---

(1) Compare with the first paragraph of the Royal Manuscript text above.

(2) SACROBOSCO, *loc. cit.*, presents similar work preliminary to the operation of multiplication.

(3) *Algorismus vulgaris*, *loc. cit.*, p. 8-9.

continet minorem aliquociens et eius aliquas partes. Vt octonarius ternarium continet tociens bis et eius duas partes. »

Interjected is also a discussion of arithmetic series quite similar to that given by SACROBOSCO, without numerical illustrations.

« Si quorumlibet numerorum hocmodo aggregatorum id est ab vnitate precedendo vsque ad quemuis numerum summam scire uolueris. Vide si impar fuerit extremis numerus, quod si fuerit duc medium in eundem et erit summa tocius. Si uero par, duc medium eiusdem in imparem qui proximo sequitur vltimum parem et erit summa tocius.

« Si tamen per partes sibi continuos fiat processus, ultimum diuide. Cuius medietatem multiplica per numerum proximo sequentem eandem medietatem vnitate addita.

« Si impares tamen maiorem medietatem ultimi in se duces. »

A second discussion of numeration and the operations of addition and subtraction terminates this arithmetic in the EGERTON manuscript. This should be compared with the corresponding parallel passages above.

« Numerorum alii sunt digiti, alii articuli, alii compositi. Digiti sunt omnes inter I et X. Articuli X et XX et sic de ceteris. Compositi sunt qui ex articulis et digitis componuntur vt XI et XXI. Figure sunt 9 que sunt huiusmodi 1, 2, 3, 4, 5, 6, 7, 8, 9 [1]. Prima figure vnitatem. Secunda binarium et sic deinceps et preter has circulus est figura huiusmodi 0 que nihil signet nisi differentiam, si figuris preponatur uersus dextram. Et sciendum est quod infi(ni)te sunt differentie. Prima incipiens ab vnitate continens omnes numeros qui sunt infra unitatem et decem. Secunda incipit a X continens omnes numeros inter X et C. Tertia incipiens a C continens omnes numeros qui sunt inter C et M^{e} et sic de ceteris. Item sciendum quod quelibet figura primo loco posito se ipsam tamen signet. Secundo loco X^{es}, decies, quod primo et sic de ceteris. Cuius igitur cognita regula numeros qui inter vnitatem et 9 M scimus legere. Item si legendi fuerint numeri plurium differenciarum quam quatuor que sunt huiusmodi id est 1 2 3 4 9 6 7 8 9 6 7 5 2. Incipiamus [2]

(1) Entirely similar to the first set of numerals in the same manuscript.

(2) LEONARD OF PISA, *loc. cit.*, p. 4, places points below as here, and also accents above the hundreds' place; SACROBOSCO places the points above. The Salem Codex (CANTOR, *loc. cit.*) places points between each set of three digits.

computare differentias a dextris computendo versus sinistram et sub quarta iterum ponatur punctus. Deinde quarta figura proxima iterum computetur versus sinistram et sub quarta iterum ponatur punctus. Et sic quotquot erunt differentie. Deinde videatur quanti figure signarent (?) versus sinistram respectu puncti. Figura que super punctum est lecta (?) quanti prima. Deinde tociens dicatur M° quot erunt puncti sub figuris. Et ad vltimum punctum versus dextram dicatur M°. Deinde est de legendo numero. Dicatur ergo de addicione.

« Additionis numeri ad numerum triplex est variacio. Quando uero addatur digitus digito et excrescit digitus. Quando articulus, quando compositus excrescit. Si addatur digitus digito superponatur maior minori. Si excrescit digitum loco maioris ablati ponatur quod excreuit. Si excrescat articulus loco superioris ponatur circulus et versus sinistra secundo loco vnitas. Si excrescat compositus videndus est qui digitus sit preter articulum et digitus ille quod preter articulum est loco superioris ponatur. Deinde secundo loco versus sinistram ponatur vnitas. Hec de addicione digiti ad digitum sufficiant. Hec de numeris plurium differenciarum. Si numerus plurium differenciarum numero plurium differenciarum addendus fuerit, figura prime differencie ponatur sub figura prime. Secunda sun secunda et sic de ceteris. Deinde addatur figura prime differencie inferioris figure prime differencie superioris numeri. Secunda inferioris secunde inferioris (*sic*). Deinde secundum datam regulam de addicione digiti ad digitum operatur.

« Sciendum quod maior numerus non possit subtrahi a minori. Si uolueris numerum minorem a maiori subtrahere, figura prime differencie inferioris ponatur sub figura prime superioris. Secunda sub secunda et sic deinceps. Subtrahatur ergo quelibet inferior a sua superiori et residuum supra ipsam ponatur. Sed si inferioris a superiori subtrahi non possit, secundo loco versus sinistram accipiatur vnitas que respectu figure auferende ualebit X (1). Iungatur ergo X cum figura a qua debet inferior subtrahi et a coaceruatione subtrahatur figura inferior et residuum loco superioris ponatur. Explicit. »

These discussions of the Hindu art of reckoning are among the earliest of those in Latin, as we have indicated both from external and

(1) Sacrobosco, *loc. cit.*, p. 4, « quae valet decem respectu proximae figurae praecedentis ».

internal evidence. The shorter of the two complete treatises on the Hindu art of reckoning may be a translation direct from the Arabic, possibly of another discussion of arithmetic by AL-KHOWARIZMI, different from that in the translation published by BONCOMPAGNI (Trattati I). However, both versions correspond closely in terminology and methods to that translation of AL-KHOWARIZMI; both present striking points of similarity to the widely popular treatises of SACROBOSCO and ALEXANDER DE VILLA DEI (1). Undoubtedly these texts present intermediate versions between the first incomplete explanations of the Hindu art of reckoning, and the complete explanation given by SACROBOSCO and LEONARD OF PISA. The documents contribute materially to our knowledge of the slow process of development by which the common methods of elementary computation were introduced into Europe.

LOUIS C. KARPINSKI.

University of Michigan,
Ann Arbor, Michigan.

(1) The dominating influence of the works of SACROBOSCO and ALEXANDER DE VILLA DEI has been shown by Dr. SUSAN R. Benedict, in a thesis, A Comparative Study of the Early Treatises introducing into Europe the Hindu Art of Reckoning, Concord, 1914.

History of symbols for n- factorial

As simple a matter as the notations for the designation of « n-factorial » (that is, of the product $1.\ 2.\ 3 \ldots n$) involves in the history of its development questions of pedagogical and philosophical interest. Is it desirable to introduce a young student into a large amount of algebraic symbolism or should there be restrictions? May the symbolism not be so extensive as to retard rather than accelerate the progress of algebra as a science?

We are led to the consideration of these questions by noting the history of factorial notations. It has been known [1] for some years that the notation $n!$ representing the product $1.\ 2 \ldots n$, was introduced over a century ago by CHRISTIAN KRAMP, professor at the University of Strasbourg, in his *Éléments d'arithmétique universelle ou d'Algèbre*, Cologne, 1808, that in the year 1811 A. M. LEGENDRE [2] denoted n-factorial by using the Greek letter Gamma, thus $\Gamma(n+1)$, and that K. F. GAUSS [3] employed for this purpose the notation $\Pi(n)$. There are a few obsolete notations; for instance, HENRY WARBURTON [4], of Cambridge, England, in 1847, represents n-factorial by $1^{n/1}$, as a special case of $S^{n/1} \equiv s(s+1).\ (s+2) \ldots (s+[n-1])$.

A. DE MORGAN [5], (who ordinarily uses no contracted symbol) employed in 1838 the designation $[n]$, as a special case, apparently,

---

(1) *Encyclopédie des sciences mathématiques pures et appliquées*, t. I, vol. I, p. 65, note 16. Paris, Leipzig 1904. PEANO, *Formulaire mathématique*, t. IV, p. 66. Turin 1903.

(2) A. M. LEGENDRE, *Exercices de calcul intégral*, I, p. 277. Paris 1811.

(3) C. F. GAUSS, *Commentationes Societatis regiæ scientiarum Gottingensis recentiores*, vol. 2, 1811-1813, *Math. mém.*, n° 1, p. 26; *Werke*, vol. 3, p. 146. Göttingen 1866.

(4) H. WARBURTON, *Cambridge philosophical transactions*, vol. 8, 1849, p. 477.

(5) A. DE MORGAN, *Essay on Probabilities, Cabinet Cyclopædia*, p. 15. London 1838.

of A. T. VANDERMONDE's (1) $[a]^m \equiv a(a-1)\ (a-2)\ldots(a-[m-1])$. R. CARMICHAEL (2) in 1857, when hard pressed for space in writing formulas, uses the designation $\overline{n}$.

Relating to the origin of the notation $\lfloor \underline{n}$ for « n-factorial », nothing has been given in histories, except the statement that it has been in use in England. We are glad to be able to throw light upon the history of this symbol, and to give some details regarding the spread of it, and of its rival $n!$, in the United States and other countries. The notation $\lfloor \underline{n}$ was suggested in 1827 by THOMAS JARRETT (1805-1882) who had just graduated from St Catherine's College in Cambridge, England, with the degree of B. A. It occurs in a paper « On Algebraic Notation » that was printed in 1830 (3). The passage in question reads as follows : « A factorial of this kind consisting of $\underline{m}$ factors, of which $\underline{n}$ is the first, and of which the common difference is $\pm r$, may be denoted by $\lfloor \underline{n}_{m,\pm r}$; the particular case in which the common difference is -1, we may represent by $\lfloor \underline{n}_{m}$ and if, in this case, $m \equiv n$, the index subscript may be omitted :

Thus
$$\lfloor \underline{n}_{m,\pm r} = n(n \pm r)\ (n \pm 2r)\ldots(n \pm \overline{m-1}\, r)$$
$$\lfloor \underline{n}_{m} = n(n-1)\ (n-r)\ldots(n-\overline{m-1})$$
$$\lfloor \underline{n} = n(n-1)\ (n-2)\ldots 1 \text{ ».}$$

In 1831 JARRETT published an *Essay on Algebraic Development* intended to illustrate and apply the system of notation he had submitted.

JARRETT subsequently became a noted orientalist who knew at least twenty languages. At Cambridge he became professor of Arabic, later of Hebrew.

For a quarter of a century the notation $\lfloor \underline{n}$ was neglected. In 1846, Rev. HARVEY GOODWIN used it freely in an article, « On the Geometrical Representation of Roots of Algebraic Equations », that was printed in 1849 (4). In 1847 GOODWIN published his *Elementary Course in Mathematics*, a popular educational manual which reached several

(1) A. T. VANDERMONDE in Mémoires de l'Académie des Sciences, 1772, première partie.

(2) R. CARMICHAEL, *Operations Calcul*, p. 30-55. Braunschweig 1857.

(3) *Transactions of the Cambridge Philosophical Society*, vol. III, p. 67. Cambridge 1830.

(4) *Cambridge Philosophical Transactions*, vol. 8, 1849, p. 343.

editions, but, to our surprise, he did not make use of any contracted notation for factorial $\underline{n}$ in this text. In fact, the symbol $\lfloor\underline{n}$ made no substantial headway in England until it was adopted by Isaac Todhunter about 1860, and was used in his popular texts. In his *History of Probability* (1) he says: « I have used no symbols which are not common to all mathematical literature, except $\lfloor\underline{n}$ which is an abbreviation for the product $1.2...\underline{n}$, frequently used but not universally employed; some such symbol is much required, and I do not know of any which is preferable to this, and I have accordingly introduced it in all my publications. » In 1861, $\lfloor\underline{n}$ was used by Henry M. Jeffrey (2). Some use of it has been made in Sweden (3), though less often than of $n!$

In the United States $\lfloor\underline{n}$ was probably introduced through Todhunter's texts. In the first volume (1874) of J. E. Hendricks' *Analyst*, (Des Moines, Iowa) both the notation $\lfloor\underline{n}$ and $n!$ are used by different writers. The latter notation, though simpler, was used in elementary texts of this country less frequently than the first. The notation $\lfloor\underline{n}$ was adopted by such prominent text book writers as Joseph Ficklin (*Complete Algebra*, copyright 1874), Charles Davies (Revised Bourdon's *Elements of Algebra*, 1877), Edward Olney (1881) and about the same time by George A. Wentworth, Webster Wells, E. A. Bowser and others. Thus it became firmly rooted in this country (4). Among the French and German authors $\lfloor\underline{n}$ has met with no favor whatever.

The notation $n!$ found wide adoption in Germany, where it is read « n-Fakultät » (5). Some texts in the English language suggest the reading « $\underline{n}$-admiration » (6) (the exclamation point (*!*) being a note of admiration), but most texts prefer « factorial $\underline{n}$ », or « n-factorial ».

---

(1) I. Todhunter, *History of the Mathematical Theory of Probability*, p. viii and ix. Cambridge and London 1865.

(2) *Quarterly Journal of mathematics*, vol. 4, p. 364, 1861.

(3) *Encyclopédie des sciences mathématiques pures et appliquées*, t. I, vol. I, p. 65, 1904.

(4) In a few publications Jarrett's factorial symbol is given in the modified form $\underline{n}\rfloor$. See, for example, Thomas Craig's *Treatise on Linear Differential Equations*, vol. 1, p. 463. New York 1889, and Webster's *New International Dictionary of the English Language*, Springfield 1919, under the word « factorial ».

(5) E. Pascal, *Repertorium*, vol. 1, p. 43. Leipzig und Berlin 1910.

(6) W. E. Byerly, *Elements of the Differential Calculus*, p. 120. Boston 1880.

In Germany, MARTIN OHM [1], whose books enjoyed popularity for many years, used the notation $n!$ about 1829. It was used in 1847 by G. EISENSTEIN, Privat Docent in Berlin, in an article quoted by J. J. SYLVESTER [2] in 1857. G. CHRYSTAL's Algebra, 1889, came out for $n!$, though in the XIXth century it was much less frequent in England than $\lfloor\underline{n}$.

In the United States $n!$ was used by W. P. G. Bartlett [3] as early as the year 1858. It was adopted mainly by a group of men who had studied at Harvard, PLINY EARL CHASE [4] (later professor of physics at Haverford), JAMES EDWARD OLIVER [5] (later professor of mathematics at Cornell) and C. S. PEIRCE [6], the logician. Afterwards $n!$ was used in SIMON NEWCOMB's Algebra (1884), I STRINGHAM's edition of CHARLES SMITH's Algebra (1897), M. MERRIAM and R. S. WOODWARD's Higher Mathematics (1898), OLIVER, WAIT & JONES' Algebra (1887), and in others.

In the present century the notation $n!$ has gained almost complete ascendancy over its rivals. It is far more convenient to the printer.

Remarkable is the fact that many writings, both advanced and elementary, do not use any contracted notation for n- factorial ; the expanded notation 1, 2, 3... n is adhered to. The facts are that a short mode of designation is not so imperative here as it is for « square root », « cube root » or « the n^{th} power ». We have seen that HARVEY GOODWIN of Caius College, Cambridge, made liberal use of $\lfloor\underline{n}$ in a research article, but avoided it in his *Elementary Course*. Instinctively he shrunk from the introduction of it in elementary instruction. We have here the issue relating to the early and profuse use of symbolism in mathematics : Is it desirable ? In the case of n- factorial some writers of elementary books of recognized standing avoid it. More than this, it has been avoided by many writers in the field of advanced mathematics, such as J. J. SYLVESTER,

---

(1) M. OHM, *System der Mathematik*, vol. 2, p. 17. Berlin 1829.

(2) G. EISENSTEIN, *Mathematische Abhandlungen*, Berlin 1847; J. J. SYLVESTER, *Quarterly Journal of mathematics*, vol. I, p. 201. London 1857.

(3) J. D. RUNKLE'S, *Mathematical Monthly*, Vol. I, No. 3, p. 84-87, Cambridge, Mass., 1858.

(4) *Trans. American Philosoph. Society*, Vol. XIII, p. 25-33. N. S., Philadelphia 1869. CHASE's paper is dated Sept. 18, 1863.

(5) *Loc. cit.*, p. 69-72. OLIVER's paper is dated May 6, 1864.

(6) *Memoirs American Academy of Arts and Sciences*. Vol. IX, p. 317. N. S., Cambridge and Boston, 1867.

A. CAYLEY, H. LAURENT, E. PICARD, E. CARVALLO, E. BOREL, G. B. AIRY, G. SALMON, W. CHAUVENET, FAÀ DE BRUNO, P. APPELL, C. JORDAN, J. BERTRAND, W. FIEDLER, A. CLEBSCH. Of course, I am not prepared to say that these writers never used $n!$ or $\underline{\lfloor n}$; I claim only that usually they avoided those symbols. These considerations are a part of the general question of the desirability of the use of symbols in mathematics to the extent advocated by the school of G. PEANO in Italy and of A. N. WHITEHEAD and B. RUSSELL in England. The feeling against such a « scab of symbols » seems to be strong and wide-spread. If the adoption of only one symbol, like our $n!$ or $\underline{\lfloor n}$, were involved, the issue would seem trivial, but when dozens of symbols are offered, a more serious situation arises. Certain types of symbols are indispensable ; others possess only questionable value. Rich meaning is conveyed instantaneously by $\frac{dy}{dx}$, $\int ydx$, but $\underline{\lfloor n}$ and $n!$ serve no other purpose than to save a bit of space. Writers who accept in toto the program of expressing all theorems and all reasoning by a severely contracted symbolism, must frame notations for matters that can more conveniently be expressed by ordinary words or in less specialized symbolism. We know that intellectual food is sometimes more easily digested, if not taken in the most condensed form. It will be asked, to what extent can specialized notations be adopted with profit? To this question we reply, *only experience can tell.* It is one of the functions of the history of mathematics to record such experiences. Some light, therefore, may be expected from the study of the history of mathematics, as to what constitutes the most profitable and efficient course to pursue in the future. The history of mathematics can reduce to a minimum the amount of future experimentation. Hence algebraic notations deserve more careful historic treatment than they have hitherto received.

University of California,
August 16, 1920.

FLORIAN CAJORI

Notes and Correspondence

The Unity History Schools at Woodbrooke near Birmingham. —I have already referred the readers of *Isis* (see II, 425-426) to the two first courses of lectures organized by F. S. MARVIN at the Woodbrooke settlement in 1915 and 1916.

A third course was hold in 1919, and a fourth one was arranged to take place on August 14-23 of this year (1920). This is the most interesting attempt that I know of to apply historical knowledge to a better understanding of the problems of to-day. The fact that it is not a university extension but a more private undertaking, does not make it less interesting. The fourth series was arranged (like the three previous ones) by F. S. MARVIN, Staff Inspector, Board of Education, England. The hosts were Mr. and Mrs. ROWNTREE of York. This fourth session was hold in conjunction with the League of Nations Union, its object being to provide a historical introduction to the League. The following lectures were announced :

ARTHUR TOYNBEE on ALEXANDER and Hellenism ; Sir PAUL VINOGRADOFF on the Work of Rome; H. W. C. DAVIS on INNOCENT III and the Mediaeval Church; G. N. CLARK on GROTIUS and International Law; G. P. GOOCH on the French Revolution as a World Force; RAYMOND BEAZLEY on the Congress of Vienna; F. S. MARVIN on the International Tendencies of the XIXth Century; H. G. WELLS on the Function of Utopias. Four other lectures were added by the League of Nations Union to explain different aspects of the League. These lectures were given by FREDERICK WHELEN, GILBERT MURRAY and EILEEN POWER.

Enquiries should be sent to the Hon. Sec., EDWIN GILBERT, 78 Mutley Plain, Plymouth, England. G. S.

Courses on the History of Science at University College, London.— German and American Universities long ago recognised the importance of the History of Science as a subject of academic study. In British Universities the subject is only just beginning to receive attention. In the University of London last year, the Faculty of Arts passed a resolution in favour of including the History of Science among the subjects for the B. A. Degree, and although the Senate has not yet dealt with the question, the inclusion of the subject in the curriculum for the new

Diploma in Journalism has helped to advance matters. University College undertook to provide the necessary courses. During the first and second terms of the session 1919-1920, Dr. WOLF delivered a course of elementary lectures on the general history and development of science till the end of the XVIII^th Century. During the present (Summer) term Prof. BRAGG and others will deal with the History of Physical Science during the XIX^th Century, and Dr. SINGER will lecture on the History of Medicine. A more elaborate programme will be provided next session. Prof. BRAGG and Dr. WOLF will repeat their courses. Prof. J. P. HILL and Dr. SINGER will deal with the History of the Biological and Medical Sciences, Prof. FILON will lecture on the History of Astronomy, and Mr. WREN on the History of Mathematics. The History of other Sciences will also be dealt with as opportunity offers.

C. S. (1920).

The International Organization of Science. — The fact that Geneva and not Brussels was selected as the seat of the League of Nations has been to Belgium a cause of bitter disappointment. I cannot insist upon that here but the reader who wishes to obtain more information will find a very able statement of the Belgian views in the following pamphlet : PAUL OTLET, *Sur l'établissement en Belgique du Siège de la Société des Nations*, 35 p. Bruxelles, 3*bis*, rue de la Régence, 1919. — In the meanwhile a strong movement is on foot to make of Brussels, if not the political capital of the League, at least its intellectual capital. There would then be three international centers, each located in a small state, as is indispensable lest the imperialistic tendencies of a greater state gain an overwhelming influence : the politic and administrative center in Geneva, Switzerland, the juridic center in The Hague, Netherlands, the intellectual center in Brussels, Belgium. These three cities are sufficiently near to make rapid personal communications between them possible; they are sufficiently distant to be very different. On the whole it seems to me that the existence of three such centers is far more auspicious than if all the international functions had been concentrated in one single place. Of course we are specially interested in the intellectual center of Brussels and we will watch its development with love and joy. It appears to be developing very well under the expert guidance of the « Union des Associations Internationales », which was founded in Brussels in 1910, and is the central organization of more than 400 international associations of every kind. This Union is the organizing agency of the *World Congresses* which were to take place at least every three years. The first World Congress met in Brussels in 1910 ; the second in 1913, the third will meet presently in

the autumn of 1920. (See : *Compte rendu sommaire de la deuxième session*, Gand-Bruxelles, 1913. *La Vie internationale*, III, p. 489-524, 1913). The Union publishes : 1. *Actes des Congrès mondiaux* ; 2. *Annuaire de la Vie internationale* (dernière édition parue : Bruxelles 1910-1911, 2652 p.); 3. *La Vie Internationale*; 4. *Code des Vœux et Résolutions des Congrès internationaux* (en préparation). It manages the following institutions, which are, so to say, the nucleus of an international center : 1. the International Museum (16 halls containing about 10,000 items); 2. the International Library (75,000 books); 3. the Universal Card Catalogue (11,000,000 cards classified by subject and author); 4. the International Archives (about 300,000 documents). (See : *L'Union des Associations internationales*, 168 p., Bruxelles 1912).

The Union is now preparing the organization in Brussels of an International University. (See : *L'Université internationale*, Notice et programme, 8 p., Bruxelles, 25 mai 1920; PAUL OTLET : *Sur la création d'une université internationale*, 39 p., Bruxelles, février 1920.)

An excellent summary of the whole question has been published by PAUL OTLET : *Centre intellectuel mondial au service de la Société des Nations*, 28 p., Bruxelles 1919, of which it will suffice to quote the table of contents : 1. Les grandes réunions internationales. Congrès et conférences ; 2. Les bureaux, secrétariats et services permanents des associations internationales; 3. Les bureaux scientifiques internationaux officiels ; 4. Le conseil international des recherches scientifiques et techniques ; 5. L'institut international du progrès social (Institut des standards sociaux); 6. Les établissements internationaux de documentation, Bibliothèque internationale, Institut international de bibliographie, Archives ; 7. L'office international de législation ; 8. L'office international de statistique ; 9. L'office international des brevets et l'institut des inventions ; 10. L'institut international des unités et des standards techniques ; 11. Le bureau international des langues ; 12. Musées internationaux ; 13. L'université internationale ; 14. Organe général des intérêts internationalisés.

All the papers quoted in this note can be obtained at the offices of the Union, 3*bis*, rue de la Régence, Bruxelles. *Isis* will periodically review the activities of the Union and of the international center. It will also publish all essential information on the international scientific congresses, as it did before the war, but only on those which are genuinely international, *not* on those from which the representatives of German, Austrian and Russian science are systematically excluded.

G. SARTON.

Reviews

Schütte, Gudmund. — PTOLEMY'S *Maps of Northern Europe*. A reconstruction of the Prototypes, published by the Royal Danish Geographical Society, XVI + 150 + XXXIII p., 31 maps. Copenhagen, H. HAGERUP, 1917.

This book is more comprehensive than its title suggests for the author has included in it a survey of the very complex manuscript problem involved by the Geography of PTOLEMY. The study of the prototype maps is an ungrateful task; it seems at first view hopeless and we must be thankful to him who undertook it even if his results be not as ample and definite as one would wish.

The present investigation was limited to the cartographic problem. The MS. atlases are divided into two groups, one with 27 maps and one with some 68. The 27 version corresponds to C. MÜLLER'S « Byzantine family » of context MSS and its main representatives are the Cod. Urbinas 82, the Athos Atlas and the Venetus Marcianus 566. The 68 version corresponds to MÜLLER'S « Asiatic family ». The Athos Atlas was reproduced in facsimile by SEWASTIONOW and LANGLOIS in 1867. The great master of historical cartography, the Rev. JOSEF FISCHER, S. J. of *Stella Matutina*, Feldkirch, has made a collection of photographs of maps included in more than 40 MSS and is carrying on a deep study of these. (Cfr. J. FISCHER, *Die handschriftliche Ueberlieferung der Ptolemaeus Karten*, 1912; *An important Ptolemy* MS., 1913). He will soon publish a facsimile edition of the Urbinas 82. SCHÜTTE based his first investigations on the Athos Atlas (ab. 1250 A. D.) but upon FISCHER'S advice he abandoned it and decided to base his work on the Urbinas 82 (ab. 1200 A. D.) which preserves the Ptolemaic atlas with greater perfection.

The manuscript problem to solve is briefly the following: most critics until now had refused to admit that the Ptolemaic atlases were directly derived from PTOLEMY'S original cartographical work; they maintained that these maps had been reconstructed from PTOLEMY'S text, possibly by the Alexandrine grammarian AGATHODAEMON in the vth century or even later and were consequently of little value.

Therefore most editors of the geography have paid no attention whatever to the maps; they studied carefully the MSS and early printed editions of the text but consistently ignored the readings of the XIII^th century atlases! It was not until the beginning of our century that a reaction against this excessive scepticism made itself felt. The leader was JOSEF FISCHER; he maintains that the better MSS atlases are true continuations of the original Ptolemaic maps, — that is the maps drawn by PTOLEMY or by his older contemporary, MARINUS of Tyre.

According to a later discovery by the Rev. P. VOGT, AGATHODAEMON could only be regarded as author of the map of the world, while the 26 regional maps of Urbinas 82 would represent the original maps. It is of course almost impossible to distinguish PTOLEMY's from MARINUS' work and therefore it is convenient to speak of their common work as that of the « Ptolemaic constructor ».

A good way of distinguishing the prototypes from the later maps is to consider the pictorial and phantastic elements which they respectively contain. As the art of cartography declined these elements increased. From this point of view, three stages can be recognized in cartographic development. I. Few pictorial elements and no living beings, that is the genuine Ptolemaic tradition; II. Growing number of pictorial elements among which some few living beings in repose; III. Complete overgrowth of pictorial elements among which several living beings in movement. The *Tabula Peutingeriana* (IV^th c.), the *Notitia Dignitatum* (V^th) and the mosaic map of Madaba (VI^th) all belong to the second stage of this development or rather of this retrogression. (See *Isis*, III, p. 320).

The study of the Ptolemaic maps and their identification with geographical realities is greatly confused by the many systematic errors which their Greek constructor could not avoid. SCHÜTTE examines these sources of error in the following order: misreadings of Latin forms, misreadings of Barbarian names, metathesis, apocope, parasitical additions, onomastic disguise, fictitious repetitions, false identification; theoretical arrangements (tendency in favour of schematic divisions, preference given to the number 3, etc.)

After this sort of introduction, SCHÜTTE begins his attempt to reconstruct the prototypes. It is impossible to resume the author's technical discussion of the various prototypes assumed by him for N. Europe. Of course such reconstruction is largely hypothetical, and the author himself is keenly aware of it, but at least he has succeeded in clearing and solving to a certain extent the Ptolemaic riddles, and for that he deserves our gratitude. A select Ptolemaic bibliography completes this important publication.

I submit the two following criticisms : 1. This memoir is not always clearly written, and there are repetitions and other faults of the same kind. It is certain that the presentation of the results leaves room for much improvement; 2. A geographical index would have been useful.

G. S.

Bensaude, Joaquim. — *Histoire de la science nautique portugaise* (Résumé), 110 p. in-4°. Genève, A. KUNDIG, 1917.

JEAN MASCART a publié naguère dans *Isis* (I, 716-718) une étude sur un autre ouvrage de BENSAUDE, son *Astronomie nautique au Portugal à l'époque des grandes découvertes*, Berne 1912. Chargé par la République portugaise d'étudier et de publier en fac-similé les documents relatifs aux origines portugaises de la science nautique, BENSAUDE n'est pas resté inactif et nous offre un résumé de ses travaux et un programme de ses recherches ultérieures. Il vaut la peine d'en reproduire ici les grandes lignes, car il est clair que la vaste enquête entreprise par BENSAUDE pourrait être facilitée et menée plus vite à bonne fin si des investigations convergentes étaient poursuivies dans d'autres pays.

I. *Reconstitution de la science nautique portugaise.* — Celle-ci débuta par la fondation de la base navale et de l'institut géographique de Sagres en 1416 par D. HENRIQUE le Navigateur, et son progrès fut enrayé en 1536 par l'introduction de l'Inquisition. L'histoire qui nous intéresse se déroule donc entre ces deux dates : 1416-1536 (1). Il est clair que D. HENRIQUE a reconnu très vite la nécessité de l'alliance de la théorie et de la pratique pour assurer leurs progrès mutuels. La collaboration intime de l'astrologue et du marin conduisit à l'élaboration de l'œuvre mère : le *Regimento do estrolabio*, avant 1485. BENSAUDE décrit brièvement l'élaboration et l'évolution de ce Règlement. Cette élaboration est le résultat de plusieurs séries d'efforts convergents : travaux de Sagres; recherche des étoiles antarctiques commencée en 1456; destruction de la légende de la zone torride inhabitable, 1471; calcul des longitudes par le soleil; étude des marées et de la gravitation; progrès de la cartographie; déviation magnétique et son application au calcul des longitudes. L'histoire de la déviation magnétique commence en 1492 (observation de COLOMB) et culmine en 1537 et 1538 dans les travaux de PEDRO NUNES et de D. JOÃO DE CASTRO qui « constituent dans leur ensemble le monument le plus remarquable de la science nautique portugaise et les chefs-d'œuvre de la bibliographie nautique européenne dans la première moitié du XVI^e^ siècle ». En 1514, JOÃO DE LISBOA avait cru pouvoir déterminer la longitude à l'aide de la

(1) La dernière date n'est pas un arrêt brusque. Il faut entendre vers 1536-1540.

déviation magnétique ; João de Castro fut le premier à montrer en 1538, l'impossibilité de cette méthode. Après que l'Inquisition eût paralysé la science portugaise, son œuvre nautique fut continuée par les géographes flamands. Bensaude termine cette première partie par un résumé chronologique, de 1416 à 1538-1541.

II. *Astronomie péninsulaire et provinciale au moyen âge.* — Ce chapitre esquisse un long programme de recherches sur la science, et plus particulièrement sur l'astronomie juive médiévale, en Espagne et en Provence. Une telle étude est indispensable à l'intelligence de l'œuvre de Zacuto (1473-1478) et de Pedro Nunes. Il y a relativement peu de livres et de Mss. en Espagne à cause des autodafés (dans les deux villes de Salamanque et de Grenade il y eut plus d'un million de volumes détruits), mais il existe un grand nombre de Mss. dans les autres bibliothèques européennes (cfr. *ex. gr.* travaux de Steinschneider).

III. *Culture scientifique portugaise.* — Le grand siècle du Portugal (de 1416 à 1538 env.) ne fut pas grand seulement dans le domaine nautique. Aux grands noms déjà cités il faudrait ajouter ceux des historiens Gaspar Correa, Damião de Goes, — d'Andréa de Gouvea que Montaigne appelait « le plus grand principal de France, — du médecin Garcia da Orta (1). Bensaude cite les noms de plusieurs autres historiens, mais il faut remarquer que l'œuvre de la plupart d'entre eux est en réalité postérieure à la période de gloire ; il en est de même de l'œuvre de Camões (1572), et de celle de Garcia da Orta (1563), toutes deux accomplies aux Indes. Cela n'est pas étonnant ; les grands historiens et poètes portugais nous donnent les derniers reflets de leur gloire nationale quand celle-ci est déjà en dessous de l'horizon. Les jalons de la décadence sont l'introduction des tribunaux de la foi en 1536, des autodafés en 1541, de la Société de Jésus en 1545. En 1580, la nation entière se vend à l'Espagne

Notre ignorance des travaux mathématiques et astronomiques de l'âge d'or n'est pas due seulement aux destructions et au chaos causés par l'inquisition ; elle est due tout autant au caractère secret que les études nautiques avaient pris dès le début.

IV. *L'étude des priorités.* — Ce chapitre a pour but de dissiper les légendes attribuant la priorité des théories nautiques à des Allemands : Regiomontanus, Behaim, Werner. Il manquait à ceux-ci le contact intime avec l'expérience, l'inspiration de l'Océan et des grandes explorations maritimes. — Ce n'est pas l'Allemagne, mais ce sont les trois nations latines : l'Espagne, l'Italie et la France qui ont rendu possible

(1) Voir *Isis*, II, p. 415-418.

l'œuvre portugaise. Un Italien, MANUEL PASSANHA (1317) fut un des premiers organisateurs de la marine portugaise ; un Catalan, maitre JACOMO DE MALHORCA fut un des organisateurs de Sagres. Rappelons aussi la tradition astronomique inspirée dès le XIII[e] siècle par les *Libros del Saber de Astronomia*, tradition magnifiquement continuée par les astrologues juifs d'Espagne et de Provence. — D'autre part, la science nautique portugaise a été le point de départ de la science nautique moderne en Europe ; cela paraît vérifié dans le cas de l'Espagne, de l'Italie, de la France et de l'Angleterre.

V. *Le rôle de la science nautique portugaise.* — Les causes et les conséquences d'ordre social des découvertes portugaises sont bien connues. Quant aux conséquences scientifiques, ce furent surtout des changements profonds dans les études astronomiques, géographiques et nautiques. Sagres est le début d'une nouvelle époque dans l'histoire de la géographie. A la méthode historique, se substitue la méthode scientifique. Plus tard l'école des géographes flamands, continuant l'œuvre portugaise, réalisera une synthèse nouvelle, par la fusion des deux méthodes.

Deux appendices complètent les informations données dans le corps du livre : I. La science nautique espagnole et PIGAFETTA (l'œuvre de celui-ci n'est qu'un reflet de la science portugaise) ; II Les prétentions de priorité de l'Allemagne (très long essai — p. 60-106 — que je n'essaye pas de résumer, mais dont les conclusions générales ont déjà été indiquées plus haut).

Il est clair que le livre de JOAQUIM BENSAUDE est plein de faits et d'idées et éminemment suggestif ; notre seul reproche c'est qu'il ne soit pas mieux écrit. Son auteur n'a pas le génie de l'ordre et de la clarté ; mais son activité inlassable et perspicace mérite toute notre reconnaissance. G. S.

R. Lespieau. — *La Molécule chimique*, 286 pages, (185×120). Paris, FÉLIX ALCAN (Nouvelle collection scientifique), 1920. [4 fr. 90]

Travail en tous points excellent dans lequel l'auteur s'est proposé d'écrire l'histoire, généralement mal connue même par les chimistes, des étapes par lesquelles est passée l'idée de la constitution des molécules (détermination du nombre d'atomes qu'elles renferment et situation de chacun d'eux par rapport aux autres), avant d'arriver à la limpidité qu'elle offre de nos jours.

Le livre s'ouvre par un chapitre dans lequel sont passés en revue et sévèrement jugés les critères habituellement donnés dans l'enseiseignement pour introduire les notions de mélanges et de combinaisons. — Suit un court exposé, d'après DEBRAY, de la notation en

équivalents ; puis de la marche adoptée par A. JOLY, vers 1892, pour introduire dans l'enseignement élémentaire de la chimie, la notation atomique en évitant l'hypothèse atomique et en se basant sur les prétendues lois fondamentales de la chimie : lois de DALTON, de RICHTER, de GAY-LUSSAC. (La collection des cours de JOLY, devenue depuis la collection JOLY et LESPIEAU, et enfin celle de LESPIEAU seul, jouit d'un succès qui ne se dément pas.)

L'auteur montre ensuite que ce n'est que par une déformation des textes de BERZÉLIUS, de DALTON, qu'on a attribué à ce dernier la paternité de cette loi toute fantaisiste dite des rapports simples, qu'on trouve encore exprimée d'une façon absolue dans presque tous les ouvrages d'enseignement. Puis il examine quelle influence ont exercée sur les conceptions de BERZÉLIUS relatives aux poids atomiques, les idées de DALTON, de MITSCHERLICH, les travaux de DULONG et PETIT sur les chaleurs spécifiques, ceux de DUMAS sur les densités de vapeur, et les découvertes de GAY-LUSSAC relatives aux volumes des gaz qui entrent en réaction chimique. Contrairement à l'opinion qui attribue aux mesures physiques le mérite d'avoir indiqué les poids atomiques actuellement en usage, nous voyons que BERZÉLIUS a su trouver la plupart de ces poids atomiques avec certitude, en se servant beaucoup plus de l'étude des réactions et des compositions chimiques que des densités de vapeur, des chaleurs spécifiques, ou de l'isomorphisme.

Mais si la plupart des poids atomiques de BERZÉLIUS sont exacts, il n'en va pas de même des poids moléculaires adoptés par le chimiste suédois. Il était nécessaire que la chimie fît de nouveaux progrès. BERZÉLIUS invoquait à l'appui de ses formules une théorie des volumes dont on savait l'inexactitude. GERHARDT en 1842, invoquant des raisons de simplicité, d'homogénéité, mais surtout préoccupé de choisir des formules en harmonie avec les propriétés chimiques, montre qu'il faut dédoubler la plupart des formules employées par BERZÉLIUS en chimie organique. La notation de GERHARDT conduit à l'adoption de volumes correspondant à des volumes de vapeur égaux (22,4 l), à 0° et 1 atm.

On arrive ainsi, par des raisons chimiques, à des formules vérifiant l'hypothèse émise par AVOGADRO en 1811, qui n'avait eu jusqu'alors aucune influence sur la notation chimique, et qui cesse pour ainsi dire dès lors d'être une hypothèse pour devenir une loi d'ordre expérimental, dont le rayon d'action a d'ailleurs été simplement agrandi par la découverte de la cryoscopie (RAOULT).

La mesure des densités des gaz, des points de congélation des solutions, fournit les poids moléculaires comme l'étude des réactions chimiques, mais celle-ci conduit en outre, après les travaux de GAY-LUSSAC, de DUMAS et BOULLAY, de BERZÉLIUS, à la notion des substitutions par résidus, qui amène GERHARDT au principe même des

formules de constitution. Ces résidus deviennent bientôt les radicaux (WURTZ, LAURENT); et de la notion de radicaux, on passe à la notion du type chimique, introduite par DUMAS, élargie par LAURENT, WURTZ, FRANKLAND, WILLIAMSON, ODLING, et surtout développée par GERHARDT. Dès lors, les formules typiques se répandent: WILLIAMSON imagine les types d'eau plusieurs fois condensée, et l'idée de valence des radicaux va faire rapidement son chemin, surtout avec COUPER et avec KÉKULÉ.

Enfin devait s'imposer bientôt la notion de la stéréochimie du carbone dont les promoteurs sont PASTEUR d'abord, puis LE BEL, VAN 'T HOFF.

De tous ces travaux qui s'interpénètrent sont sorties les formules moléculaires actuellement en usage. Certes, elle ne sont pas parfaites; M. LESPIEAU relève toutes les objections qui peuvent être faites aux formules développées, à la notion de valence, à celle des stéréoisomères. Mais il n'est besoin, pour montrer le rôle qu'elles peuvent jouer encore à l'heure actuelle, entre les mains d'un savant qui ne perd jamais de vue ce principe fondamental que les formules chimiques doivent rappeler les réactions, qu'à considérer la voie récemment ouverte par les travaux de WERNER sur la chimie des complexes.

L. GUINET (Bruxelles).

Sivanath Sastri. — *History of the Brahmo Samaj*, vol. I, XIX + 306 + LXXVI + 15 p., 1911; vol. II, VIII + 566 + XXIV + 29 p., 1912. Calcutta, R. CHATTERJÉE.

L'auteur de cet ouvrage en entreprit la rédaction dès 1888 à la requête de Miss S. D. COLLETT, qui a écrit elle-même une histoire du Brahmo Samaj, et mit à sa disposition les documents nombreux qu'elle possédait. Il hésita longtemps à la terminer et à la publier, craignant que la part active qu'il avait prise au mouvement Brahmo l'empêcherait d'être impartial. Disons tout de suite que son œuvre dégage une très forte impression non seulement d'impartialité et d'honnêteté mais aussi de vraie charité intellectuelle. Indépendamment des histoires et des biographies déjà publiées, l'auteur a pu utiliser des documents inédits nombreux. Malheureusement son livre est très mal ordonné et pauvrement écrit. Le deuxième volume surtout est plutôt un amas de matériaux qu'une œuvre achevée. Cependant, malgré ces défauts, auxquels il faut ajouter une pénible prolixité, cet ouvrage est singulièrement intéressant.

En effet il nous fait assister à l'évolution d'une institution religieuse et nous offre presque inconsciemment, comme la vie même, une foule de petites leçons de psychologie sociale et religieuse. L'auteur nous donne

de courtes biographies des principaux personnages qui ont guidé cette évolution. Ces biographies ingénues sont des documents psychologiques de premier ordre ; elles nous aident à saisir le développement intellectuel et sentimental des « leaders » religieux.

Le Brahmo Samaj [un Brahmo est un adorateur de Brahma, l'esprit suprême de l'Univers, c'est-à-dire un théiste ; Samaj signifie société ; le Brahmo Samaj est donc la Société des Théistes] a été créé le 20 août 1828, par le Raja Ram Mohun Roy (1772-1833) ; le premier temple fut consacré le 23 janvier 1830. Ce mouvement était surtout une réaction contre l'animisme et l'idolâtrie hindouistes. Roy était un Hindou, mais il avait été fortement influencé par une éducation arabo-persane et avait rêvé une fois de plus de concilier les aspirations religieuses de l'Inde et de l'Islam. Le Brahmo Samaj était un culte monothéiste, répudiant les idoles, les saints, les images ; c'était une sorte de réaction protestante. Roy s'efforça de lui conserver le caractère d'une institution purement hindoue et aussi celui d'une institution purement religieuse, capable d'unir tout les hommes quelles que fussent leurs conceptions d'ordre social. A la mort de Rammohun Roy, la jeune église vivota jusqu'au moment où Devendra Nath Tagore (1817-1905) en devint le directeur. Malgré l'extrême modération de celui-ci, l'église ne cessa d'évoluer. A la suite de longues discussions sur l'infaillibilité des Védas, il ne put résister aux tendances rationalistes ; plus tard il ne réussit pas davantage à contenir les poussées d'ordre social qui amenèrent peu à peu un schisme dans l'église.

Le troisième inspirateur, le plus génial des trois peut-être et certainement le plus complexe, fut Keshub Chunder Sen (1838-1884). Celui-ci avait été fortement influencé par la pensée chrétienne et il étendit encore le syncrétisme du Samaj. Il attacha de plus en plus d'importance aux devoirs purement moraux et sociaux, introduisit dans son église les idées chrétiennes de repentir et de prière ; il y introduisit aussi la ferveur et l'habitude des dévotions journalières et insista surtout sur la pensée déjà énoncée par le Rajah Roy que « le service de l'homme est le service de Dieu ». En somme sous l'influence de Sen, le Brahmo Samaj au lieu de rester une sorte de protestation contre les superstitions religieuses, prit un caractère positif. Malheureusement, le mariage de la fille de Sen en 1878, dans des conditions qui impliquaient un abandon de l'idéal du Samaj, causa un très grand scandale, un nouveau schisme et amoindrit l'influence morale de l'Eglise en même temps que celle de son chef.

Plusieurs documents sont reproduits *in extenso* dans les appendices. La publication d'un troisième volume était annoncée en 1912, mais je ne sais s'il a paru.

G S.

Συμβολαὶ εἰς τὴν ἱστορίαν τῶν φυσικῶν ἐπιστημῶν καὶ ἰδίως τῆς χυμείας ὑπὸ ΜΙΧΑΗΛ Κ. ΣΤΕΦΑΝΙΔΟΥ. ε + 232 Σελ. Ἐν Ἀθήναις. Βασιλικὸν τυπογραφεῖον ΝΙΚ. ΑΘ. ΧΙΩΤΗ, 1914.

[τιμᾶται Δραχ. 4].

MICHEL STÉPHANIDÈS, professeur agrégé d'histoire de la chimie à l'Université d'Athènes et collaborateur au Dictionnaire historique de la langue grecque, nous offre ici une collection de quatorze essais relatifs à l'histoire des sciences. Ces essais ont paru d'abord dans diverses revues grecques et étrangères. Je me borne à renvoyer ici aux dernières. Voici quelques indications au sujet de chacun de ces essais.

I. Σκέψεις περὶ τῆς ἀρχαίας ἑλλ. ἐπιστήμης (*Réflexions sur la science grecque ancienne*). — Dans nos comparaisons entre les connaissances scientifiques des anciens et des modernes il ne faut pas se laisser induire en erreur par l'identité de certains termes techniques. La caractéristique de la science grecque c'est un mélange d'observation et d'inspiration. Le grand organisateur de la science antique, ARISTOTE, base la recherche sur deux axiomes : 1° la Nature ne fait rien en vain; et 2° il ne suffit pas de considérer une partie d'une question, il faut la considérer tout entière. La meilleure méthode de l'histoire des sciences est la méthode critique.

II. Ἐπιστήμη καὶ ἀδράνεια (*Science et inertie*). — (Voir aussi *Revue des Études grecques*, t. XXXI, p. 205. Paris 1918.) Esquisse d'une philosophie de l'histoire basée sur l'extension du principe de l'inertie de son domaine propre à toutes les manifestations de notre vie. Les hérédités, les habitudes, les instincts, les préjugés, les croyances sont comme des mouvements rectilignes uniformes ; le retour des idées (l'avatisme de la science) est comme un mouvement rotatoire. La science traditionnelle et la pensée novatrice sont comparables respectivement à des forces centrifuge et centripète.

III. Ψαμμουργικὴ καὶ Χυμεία (*L'art psammurgique et la chimie*). — (Voir Chymeutische Miscellen, *Archiv. f. d. Gesch. d. Naturw.*, 1911, Bd. 3, p. 180.) L'auteur montre que la Chrysopée prit son origine dans la métallurgie des sables aurifères de l'Égypte, donne une nouvelle étymologie du mot Χυμεία et révèle des méthodes des laboratoires chymeutiques, considérées jusqu'ici comme tout à fait fantastiques. Le travail mécanique de la réduction des roches noires contenant le quartz blanc aurifère en sables, s'appelait Psammurgie ou art psammurgique. Le traitement de ces sables par le feu était exécuté par les prêtres dans leurs temples. Les sables mélangés avec des fondants, dont le principal était le plomb, se transformaient en une fonte d'or (τοῦ χρυσίου

τὸ χύμα). A l'époque des invasions des Ethiopiens et surtout des Perses, les prêtres tinrent secret l'art sacré de la chrysopée, c'est-à-dire la fabrication de l'or par les fondants seuls. De cet art sacré les Grecs d'Alexandrie ont dérivé la Χυμεία ou chymeutique, c'est-à-dire l'art de la préparation du chyma (composition) de substances métalliques transmuables en or. Cet art était basé sur une théorie de métaux. Ceux-ci s'appellent des sables (χυτά) et sont considérés comme des corps primitifs ou simples (genres) qui se combinent entre eux par affinité (συγγένεια) ou en s'altérant produisent les espèces (oxydes et sels). Pour transformer ce chyma en or, on le colorait d'abord en noir (la couleur des terrains aurifères), puis en blanc (la couleur du quartz) par des lavages avec les eaux divines (rappelant le lavage des sables) et enfin en jaune (la couleur de l'or) au moyen d'une substance intermédiaire (το μεσιτεῦον) qui en se développant devint la pierre philosophale. Ce procédé s'appelait méthode égyptienne, opposée à la méthode persane, qui pratiquait la chrysopée à l'aide d'enduits externes. C'est ainsi que cette Χυμεία ou Χυμευτική, l'art de chyma, est un produit de la civilisation grecque d'Alexandrie. Se basant sur ces données, l'auteur divise l'histoire de la chimie en quatre grandes périodes : 1° la *Prochimie*, les connaissances minéralogiques et métallurgiques des anciens ; 2° la *Chymeutique* ou l'art sacré des chymeutes grecs d'Alexandrie et de Byzance ; 3° l'*Alchimie* ; 4° la *Chimie* moderne.

IV. Σημειώματα ποικίλα. — *Notes diverses* publiées dans diverses revues, par exemple : *Mitt. zur Gesch. d. Med.*, t. XIII, p. 39 ; *Berliner Philol. Woch.*, 1914, p. 1472 ; *Chemiker Zeitung*, 1911, p. 1267 ; *Byzantinische Zeitschrift*, 1913, t. XXI, p. 377-380 ; *Revue des études grecques*, t. XXVIII, p. 39-42, t. XXXI, p. 197-206 ; 1° notes chymeutiques et alchimiques, explications et corrections aux textes des alchimistes grecs (Berthelot), aux Papyrus de Leide (Leemans) et Holmiensis (Lagercranz), etc. ; 2° notes prochimiques, explication d'anciens textes chimiques ; 3° notes physiques, explication d'anciens passages physiques.

V. Εἰς τὴν ἱστορίαν τῆς ἀναλυτικῆς χυμείας (*Contribution à l'histoire de la chimie analytique*). — Voir *Mit. zur Gesch. d. Med.*, t. XV, p. 85-89, 1915).

VI. Περὶ τῶν ποτίμων ὑδάτων παρὰ τοῖς ἀρχαίοις (*Les eaux potables dans l'antiquité*). — Voir *Revue des études grecques*, t. XI, p. 480-1, 1912 ; 1° l'eau, les propriétés de l'eau ; 2° les eaux, eaux célestes, eaux de neige et de glace, eaux de pluie, eaux stagnantes, eaux chaudes, orientation des sources ; 3° examen de l'eau potable, densité, aspect, odeur, goût, propriétés digestives ; essai de l'eau par le vin, examen de sa température, de sa capacité de cuire les légumes, de blanchir le linge.

d'attaquer le cuivre ou l'argent; 4° adoucissement de l'eau par l'ébullition, le filtrage et le repos; l'eau battue. Cet essai contient une complète terminologie hydraulique des anciens avec renvois détaillés aux sources (Les essais III et VI sont les morceaux de résistance de l'ouvrage ; ils en forment la moitié.)

VII Περὶ βαρύτητος παρὰ τοῖς ἀρχαίοις (*La gravitation dans l'antiquité*).

VIII. Περὶ θερμοῦ καὶ ψυχροῦ παρὰ τοῖς ἀρχαίοις (*Le chaud et le froid dans l'antiquité*). — Comparaison des idées des anciens avec les doctrines modernes.

IX. Γαλιλαῖος καὶ Ἀριστοτέλης (GALILÉE *et* ARISTOTE). — La première loi de la chute des corps et le principe de l'inertie se retrouvent dans la physique d'ARISTOTE.

X. Περὶ πέψεως κατ' Ἀριστοτέλην (*La πέψις d'après* ARISTOTE). — Le mot πέψις chez ARISTOTE est un terme général qui sert à désigner la digestion, la maturation des fruits, la cuisson et la coction, la putréfaction.

XI. Τὰ τελικὰ αἴτια κατ' Ἀριστοτέλην (*Les causes finales d'après* ARISTOTE).

XII. Τὰ χρυσεῖα τῆς Μ. Ἀσίας ἐν τῃ ἀρχαιότητι. — La réputation du Pactole de rouler des paillettes d'or est une légende causée par la fertilité de la Lydie.

XIII. Ἡ μίλτος, ἡ σανδαράκη καὶ τὸ κιννάβαρι παρὰ τοῖς ἀρχαίοις (*Le milte, la sandaraque et le cinabre des anciens*) — Détermination de ces trois minéraux rouges et explication des textes anciens y relatifs. (Voir *Revue des Études Grecques*, 1918, t. XXXI, p. 197-206.)

XIV. Μεταλλουργικὰ μυστήρια (*Les mystères métallurgiques*). — Petite note sur les mystères métallurgiques en Égypte et en Grèce.

On voit que le livre du Prof. STÉPHANIDÈS contient une abondante collection de faits et d'idées et mérite d'être étudié. Il est regrettable qu'il n'ait pas cru devoir y ajouter un index renvoyant aux textes et aux termes techniques cités. En dehors des autres articles du même auteur auxquels j'ai fait allusion au cours de mon analyse rapide de son livre, il faut encore citer ses « Petites contributions à l'histoire des sciences » parues dans la *Revue des Études grecques*, 1915, t. XXVIII, p. 39-42 et 1918, t. XXXI, p. 197-206, et une note dans les *Comptes Rendus de l'Académie des Sciences* sur le feu grégeois ou le feu liquide des Byzantins (t. 167, p. 165-167, Paris, 1918). D'après les textes byzantins, le feu liquide des Byzantins n'était autre que le pétrole, nommé alors *naphtas* duquel mot provient peut-être aussi, par une traduction grecque, le terme feu liquide.

J'espère beaucoup pouvoir publier plus tard dans *Isis*, des notes de M. STÉPHANIDÈS sur l'histoire des divers termes techniques grecs.

G. S.

Hermann Diels. — *Antike Technik.* Sieben Vorträge. Zweite, erweiterte Auflage. Mit 78 Abbild., 18 Taf. und 1 Titelbild, VIII + 243 S. Leipzig, TEUBNER, 1920.

In normal circumstances the first ed. of this book which appeared in 1914, would have been duly reviewed in *Isis*. Fortunately a second edition just published gives us a new opportunity to speak of it. This new ed. is considerably enlarged, a seventh essay on ancient clocks (80 p.) having been added. The text of the other essays has also been slightly improved. Short remarks on the 7 essays follow :

I. *Greek science and technology* (39 p.). — A general survey of the subject read at the « Marburger Philologentag » in 1913, concluding apropos of ARCHIMEDES with a strong plea for a more intimate union between theory and practice, and a warning against stereotyped teaching.

II. *Ancient doors and locks* (17 p.). — From the time of HOMER on. Excellent account with a number of illustrations. Deals chiefly with Homeric and with *balanos* locks.

III. *Steamengine, automaton, taximeter* (14 p.). — Chiefly about HERO of Alexandria.

IV. *Ancient telegraphy* (20 p.). — Deals with ciphered and other secret messages in antiquity and with various methods of communication between distant places.

V. *Ancient artillery* (30 p.). — Deals with mediaeval knowledge as well.

VI. *Ancient chemistry* (34 p.).

VII. *Ancient clocks* (78 p.). — This, by far the longest essay of the series, was read before the Prussian Academy of Sciences in 1917. DIELS speaks first of the various gnomons, including a study of the famous « twin dials » discovered at Pergamum in 1907 and of many other famous sundials of antiquity with the necessary explanations and diagrams, — then of the various types of clepsydras and finally of a few mechanical clocks of mediaeval times. DIELS had himself reconstructed the astronomical Salzburg clock after having identified its fragments with VITRUVIUS' description of a *horologium hibernum*, or *anaphoricum*, but the model constructed by him was destroyed by the

German soldiery which plundered the Academy on Nov. 10, 1918 (O Nemesis!).

These essays do not bear analysis. Suffice it to say that they are excellent accounts of each subject, clear, complete, up-to-date, with profuse bibliographical information and other references. It is very gratifying that one of the greatest classical scholars of our time has taken the pains of making such elaborate investigations into the technology of the ancient. Is it a sign of a change of heart in the philological brotherhood, or is HERMANN DIELS still a glorious exception?

At any rate we welcome his generous attempt to reconcile science and the humanities and propose it as a noble example to the philologists and to the scientists.

G. S.

Carra de Vaux, Bernard (Baron). — « Notes d'histoire des sciences ». *Journal Asiatique*, t. 10, p. 449-461 Paris 1917.

I. MAURISTOS. Le savant grec auquel les Arabes attribuent l'invention de l'orgue. Peut-être ARISTON ou ARISTOS, l'ami auquel PHILON dédie ses ouvrages? C. d. V. doute de la réalité de ce MAURISTOS inconnu des Grecs. — II. PULISA. Un savant grec alexandrin? peut-être PTOLÉMÉE? — III. Le ḳarasṭoun. Ce mot signifie balance, ce n'est pas un nom d'auteur, HÉRISTON, comme l'a cru DUHEM. — IV. La numération par signes. Pratiquée par les Arabes et enseignée dans un traité perdu de ABOU'L-ḲÂSIM EL-ANTAKI († 987). — V. La sémantique calculer-jeter. — VI. Sens du mot ġobâr. Poussière, le calcul ġobâr est celui que l'on fait en traçant les chiffres sur la poussière. Autre interprétation : l'écriture ġobâr est « une écriture si ténue qu'elle ne peut être lue qu'avec un effort de la vue ». Le mot ġobâr est resté spécialement appliqué à la variété occidentale des chiffres arabes. — VII. La règle des buveurs. *Regula potatorum* ou *regula virginum* ou *regula coeci, coecis*. Or, sîkî en persan veut dire vin. La règle serait d'origine persane? — VIII. Le double sens du mot *cifra* : chiffre et zéro. Ce double sens est dû au fait que deux termes arabes parfaitement distincts sont venus se confondre dans le seul mot *cifra*. — IX. La suspension à la CARDAN. Le participe persan gardân, qui tourne (gardâniden = tourner) suggère que c'est une similitude de noms qui fit attribuer à CARDAN cette invention antique transmise par la Perse.

Ce résumé aussi bref que possible suffit à montrer l'intérêt que présentent les notes de B. CARRA DE VAUX, même si l'on ne peut s'empêcher d'être un peu sceptique quant à l'emploi des procédés étymologiques. Aux indications données par l'auteur, je me permets d'ajouter les suivantes :

I. C'est la publication dans *Al Machriq* du texte arabe de trois traités grecs perdus sur les orgues par le P. Cheïkho, Beyrouth 1906, qui a suggéré cette première note. Ce même texte a causé la publication d'un mémoire important de Wiedemann et Hauser. « Byzantinische und arabische akustische Instrumente ». *Archiv f. gesch. d. Naturw.*, VIII, p. 140-166, 1918 (*Isis*, III, p. 478-479).

IX. Sur la suspension à la Cardan, voir Berthold Laufer, Cardan's suspension in China, Holmes' anniversary volume, p. 288-292, 1 pl. Washington 1916. Laufer y décrit un brasier ou brûle-parfum chinois (Ming) — un bol monté à la Cardan à l'intérieur d'une sphère. La tradition chinoise attribue cette invention à Ting Houan, un mécanicien fameux de l'époque des Han. Son origine est évidemment hellénistique. L'explication étymologique proposée par Carra de Vaux est intéressante, mais n'est-il pas plus simple d'admettre que la suspension porte le nom de Cardan, parce que c'est en effet à Cardan que les Occidentaux modernes doivent de l'avoir connue? G. S.

Singer, Charles. — *Early English Magic and Medicine.* From the Proceedings of the British Academy, vol. IX, 34 p., 12 fig. London, H. Milford, 1920. [4 sh.].

I believe it worth while to publish a rather long analysis of this brilliant study of English pre-Arabian medicine, hoping that it may entice a few more men to help Singer to reclaim this most promising ground. Pre-Arabian or Dark Age medicine, as far as England is concerned, extends to as late a period as the middle of the XIIIth century. What we know of it is based on archaeological and literary evidence, and Singer has considered only the literary material, that is the manuscripts. In such a study there are three sources of error against which we must guard : 1. « We must resist the temptation of inferring the primitiveness or the reverse of any practice from the date of the MS. in which it is found » ; 2. Magic is an essentially syncretic process. Magical practices spread easily very far and they may remain unaltered a considerable time. Hence any judgment based on the occurrence of such practices must be extremely careful ; 3. The actual language in which the documents have come down to us — English or Latin — is hardly more than an accident.

After these preliminary remarks, Singer proceeds to decompose the very complex mass of Anglo-Saxon medico-magical literature, and analyzes successively the eight following constituent parts :

I. *Greek medicine filtered through Latin* (*true Dark Age Medicine*). — We must distinguish on one hand the *real translations*, the most popular authors being Dioscorides, Galen, Oribasius (IVth c.), Alexan-

DER of Tralles (VIth) and PAUL of Aegina (VIIth) and the *adaptations* such as PSEUDO-DIOSCORIDES, *de herbis feminis* (VIth?), PSEUDO-APULEIUS, *de herbis* (IVth?), SEXTUS PLACITUS PAPYRENSIS, *de medicina ex animalibus* (IVth?), MARCELLUS EMPIRICUS of Bordeaux, *de medicamentis* (Vth) and the Pseudo Hippocratic Epistles (IVth?). The fundamental ideas of this debased Greco-Latin medicine is the doctrine of the four elements

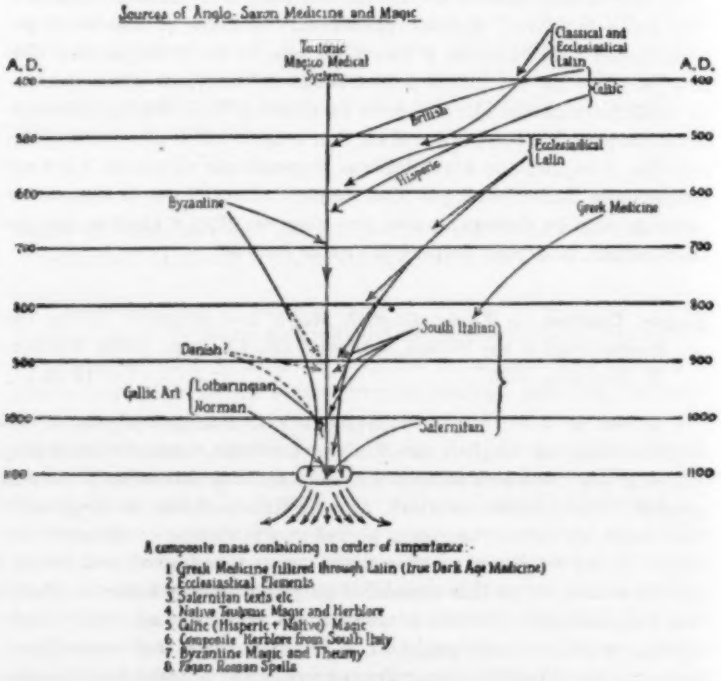

FIG. 2.

and the four humours, and the close relation between the macrocosm and the microcosm. Some magical devices, such as the Sphere of PYTHAGORAS reached England by this channel.

II. *Ecclesiastical elements.*

III. *Salernitan texts.* — These two elements are easily traced and need only be mentioned.

IV. *Native Teutonic Magic and Medicine.* — This may be distinguished from the material belonging to the previous groups by the presence of four characteristic elements : the doctrine of specific venoms, the doctrine of the nines, the doctrine of the worm as the

cause of disease and lastly the doctrine of the elf-shot. Much of this Teutonic material is properly Indo-Germanic but it was introduced in England through Teutonic channels.

V. *Celtic Magic.* — True Celtic magic in the Leechdoms is betrayed by a number of Celtic words and phrases used as charms, also by the use of such symbols as the so-called « Circle of COLUMCILLE ». Apart from this Celtic magic proper one must also consider the very peculiar form of magic which filters through the Hisperic medium. The Hisperic literature (so called from its longest and most important monument, the *Hisperica Famina*) is written in an extraordinarily artificial and syncretic language containing English, Celtic, Greek, Hebrew, Syriac and other elements. Its authors were men of Celtic speech; its center of activity was probably Ireland and it flourished chiefly in the VII^th century. The most important MSS. date however of the VIII or IX^th century.

VI. *Southern Plant-Lore.* — This is perhaps the most attractive of all the elements constituting Anglo-Saxon medicine. The early English botanical texts are debased copies of classical works, but the figures illustrating their herbals are sometimes original and interesting, « some of these attain a degree of realism and truth exhibited in no other department of mediaeval art ». Let us hope that an extensive study of these early herbals will soon be made. Anyone undertaking it should get into touch with SINGER and avail himself of the rich manuscript material which he has already collected. I will only say here that the early English herbals were made under Southern influence; they do not seem to be connected with the famous Viennese DIOSCORIDES MS. (VI and VII^th c.).

VII. *Byzantine Magic and Theurgy* — Scattered instances of the use of Greek script or phrases in the writing of a word of power, none of which clearly involves a knowledge of the Greek language.

VIII. *Pagan Roman spells.* — This, like the preceding source, is more a matter of accident, than a real tradition. Ancient and distant material always appealed to the mystic mind because of its exotism and often because of its very unintelligibility, and once included in the magical system the formidable traditionalism of superstition would keep it in indefinitily.

I must refer the reader to SINGER's paper for more details, although the paper itself is not at all an exhaustive treatment of the subject, but simply a most suggestive programme. G. S.

Franz Joh. Müller. — *Studien zur Geschichte der theoretischen Geodäsie*, VIII + 203 S. Augsburg, Rosenaustr., 38, 1918.

Collected essays on the history of geodesy, formerly published in the *Zeitschrift des bayerischen Geometervereins* between 1906 and 1909. The whole if not a complete history, is a least a very remarkable collection of the fundamental materials for such history. The two main problems of higher geodesy are the measurement of the terrestrial spheroid, and the determination of the shortest distance between two points of its surface. Although PETER APIANUS had some notion that the earth was not a perfect sphere, the history of the first problem only begins with HUYGENS and NEWTON. The history of the second problem starts later of course, in 1697 when JOH. BERNOULLI enounces it clearly; « Deux points étant donnés sur une superficie convexe, on demande une manière d'y décrire géométriquement d'un de ces points à l'autre la ligne la plus courte », although he considers only surfaces of revolution. The following year, the same BERNOULLI, stimulated by a letter from LEIBNIZ, discovered the fundamental property of the geodesic line, that is, that it has for its principal normal at every point the normal to the surface at that point. That was a splendid beginning, but BERNOULLI and his brother dropped the subject there and one has to wait 35 years for the next development : CLAIRAUT, 1733. Dr MÜLLER has tried to consider the works of all the authors who dealt with geodesic lines. It is clear that I cannot make here a detailed summary of his investigations. It will suffice to say that for each author he has gone back to the sources, which he quotes, giving extracts from the original text whenever possible and that his explanations are clear, brief and to the point. Dr MÜLLER gives us also enough biographical information about each mathematician considered by him, to give to his history a touch of life and humanity.

After CLAIRAUT comes EULER 1755; then DIONIS DU SÉJOUR (*Traité analytique des mouvements apparents des corps célestes*, 1787-1789); DELAMBRE; LEGENDRE; LAGRANGE. Contrast between French and German geodesy by the end of the XVIIIth century. The first German geodetic work was undertaken in Württemberg and Bavaria respectively by BOHNENBERGER (1765-1831); and JOH. GEORG VON SOLDNER (1776-1833). BARNABAS ORIANI (1752-1832). GAUSS; BESSEL. The compilers : PUISSANT, LAPLACE, FRANCŒUR in France; J. L. SPATH, J. C. EDUARD SCHMIDT, J. A. GRUNERT, DECKER and PH. FISCHER in Germany.

At the end of the Hanoverian degree measurement by GAUSS a second stage in the development of geodesy was completed (if we consider as a first stage the period of the French degree measurements). With

the beginning of the third and latest stage (BAEYER 1831), division of labour sets in : part of the work is now being done by physicists, another part by astronomers, another by mathematicians; the synthesis and the executive work remaining in the hands of the professional geodesists. JOH. JAK. BAEYER (1794-1885), K. G. J. JACOBI; P. A. HANSEN; BACHOVEN VON ECHT; WINTERBERG; HALPHEN; BREMIKER; JORDAN. Modern researches on the applications of the theory of geodesic lines to surveying problems : SADEBECK; ALBRECHT; JORDAN; CISCATO; NOBILI; PIZETTI; FORSYTH. — New textbooks : CLARKE 1880; HELMERT 1880; W. JORDAN and K. STEPPES, 1882; PAOLO PIZZETTI 1905; BUCHHOLZ 1908. The encyclopaedias (examination of eleven encycl. from the geodesic point of view. By the way a most interesting and useful undertaking. Should such comparisons be repeated about many other topics we would at last be able to compare and weigh the various encyclopaedias in a scientific way). A last chapter contains additional notes on : Priority discussion between IVORY and BESSEL; STEIN's textbook 1825; ISAAC DALBY (1744-1824); ISAAC TODHUNTER; G. ZACCHARIAE; PUCCI's textbook 1883-1887. A very useful book. G. S.

Hans Driesch. *The History and Theory of Vitalism.* Authorized translation by C. K. OGDEN (Revised and in part rewritten for the English edition by the author), VIII + 239 p. London, MACMILLAN. 1914.

I think that nobody has presented the vitalistic point of view more clearly and more forcibly than HANS DRIESCH. It is no wonder then that the German edition of his History and Theory of Vitalism (1905) has soon become a classic of biological philosophy and has had the honour of being translated into Italian and into English. It would hardly be necessary to review this book if its new English form were not substantially different from the original one.

There are three parts in the book : a short introduction, the historical part (175 p.) and the theoretical part. The historical part has remained essentially the same, but the theoretical part is very different, the author's views having changed in the meanwhile « The change is due to the fact that he no longer believes that qualitative Energetics can take the place of a real theory of matter (whether mechanical or electrodynamical). He now regards a critical metaphysic as possible, and no longer supports any kind of conceptual phenomenalism as the final word of philosophy ».

The introduction is devoted to a definition of the subject. DRIESCH distinguishes three kinds of teleology : purely descriptive, static and dynamic. Static teleology leadsto a mechanistic theory of the organism ; for ex., L. J. HENDERSON's works are admirable expositions of

static teleology. Dynamic teleology leads to vitalism, that is to the recognition of the « autonomy of vital processes ». This distinction between static and dynamic teleology gives the author a criterion by which he can test every body of doctrine and makes easier his historical analysis.

This analysis proceeds in the following way (I only quote the names of the protagonists as selected by DRIESCH) : *a*) ARISTOTLE ; *b*) HARVEY, GEORG ERNST STAHL ; *c*) BUFFON, NEEDHAM, MAUPERTUIS, C. F. WOLFF, BONNET, HALLER, BLUMENBACH ; *d*) KANT ; *e*) OKEN, REIL, TREVIRANUS, JOH. MÜLLER, LIEBIG, SCHOPENHAUER. So much for what he calls the old vitalism. — A second chapter is devoted to the critics and the materialistic reaction (LOTZE, BERNARD ; the Materialist-Darwinian tendency) ; a third one, to modern vitalism (ED. v. HARTMANN, EDM. MONTGOMERY, etc.).

I will not attempt an analysis of the theoretical part, as it would almost inevitably entice me to discuss the vitalistic ideas. This part is very different from the corresponding one in the German edition of 1905. The German text offered an *inductive* view of the question. The same method has been used by DRIESCH in two other books : The Science and Philosophy of the Organism (GIFFORD lectures). London, BLACK 1908 and The Problem of Individuality (London lectures), London, MACMILLAN, 1914. On the contrary in this English translation an attempt is made to develop what might be called « *deductive* vitalism » : « a real union of logic and biology, or rather a filling out of certain departments of logic with biological facts » (p. 188). The same trend characterizes his « Ordnungslehre, ein System des nicht metaphysischen Teiles der Philosophie mit besonderer Berücksichtigung der Lehre vom Werden », Iena, DIEDERICHS, 1912 and also « Die Logik als Aufgabe, eine Studie über die Beziehung zwischen Phänomenologie und Logik zugleich eine Einleitung in die Ordnungslehre », Tübingen, MOHR, 1913.

I try to mention and analyze briefly in the Critical Bibliography of *Isis* the main publications on the vitalistic controversy and the reader will find under the heading « Biology », an up-to-date bibliography of the subject. I beg to draw his attention to the results of a symposium at HARVARD University published in the *Philosophical Review*, t. 27, p. 571-645 (see *Isis*, III, p. 128). G. S.

Edv. Hjelt. — *Geschichte der organischen Chemie von ältester Zeit bis zur Gegenwart*, XII + 556 S. Braunschweig, FRIED. VIEWEG, 1916.

But for a much shorter history published by SCHORLEMMER, almost thirty years before (1) this is the first book exclusively devoted to the

(1) *Der Ursprung und die Entwicklung der organischen Chemie*, VII + 199 S. Braunschweig, VIEWEG, 1889.

development of organic chemistry. Originally written in the form of independent monographs, it is very remarkable to what extent its author has been able to consolidate these fragments into one harmonious whole. It is a well-informed, well-digested and well-written account. No attempt has been made to give us biographical sketches of the chief actors but HJELT has made extensive use of memoirs, letters and other biographical materials to allow us to understand the psychological basis of this history, that is the development of chemical ideas in the minds of rival scientists. The history of chemistry in the XIXth century opens a splendid field for such psychological investigation because of the long controversies which went on in an almost uninterrupted succession. — Outside of the biographical details having an immediate bearing on these controversies, HJELT does not give us any information on the men to whose labour and devotion we owe the progress of organic chemistry. He seems to assume that the reader knows them anyhow. This is a great mistake, the more so that I hope that many young chemists will study his book and use it as a source of inspiration for their own work. On the other hand as it is not at all easy to interrupt repeatedly one's narrative in order to insert the necessary portraits, the best solution would perhaps be to place these in the footnotes as was done, for inst., by KARL VON ZITTEL in his history of geology. I hope that a new edition may soon give HJELT an opportunity to add these biographical sketches. He might then also add a subject-index, the absence of which in a book of this kind can but be deprecated.

The plan of the book seems very satisfactory. Of course the development of *organic* chemistry did not really take place until after the beginning of the last century. HJELT did well not to devote more than a short chapter to the preceding times, since whatever was known in those times belongs rather to the history of chemistry, than to the history of any of its (then inexisting) branches. But from the beginning the development of organic chemistry took place in many various directions and it soon became exuberant and really bewildering. The historian's greatest difficulty is then to reconcile the needs of a chronological sequence and of a systematic and intelligible account. HJELT has solved this problem by collecting the great mass of facts involved in the discovery and study of new substances (what we might call descriptive chemistry) into four chapters (IV, VIII, XI, XVIII) relating to four consecutive periods. Each of the other chapters is then devoted to some topic of theoretical chemistry, as much as possible in the chronologic order of their apparitions. The order is as follows (for brevity sake, I only quote the most important topics of each chapter): I. Prehistory (which contains for ex. a paragraph devoted to what

R. LULLUS called the *consolatio ultima corporis humani*, alcohol). — II. Conception of organic chemistry. — III. BERZELIUS's views on organic chemistry. WÖHLER's synthesis of urea. Views on organic synthesis. — IV. Descriptive chemistry, 1800-30; Isomerism (1822-35). — V. Constitution of ethers; radical theory. — VI. Substitution theory (1834-45). — VII. LIEBIG's theory of polybasic acids; GERHARDT's and LAURENT's efforts; Unitarism; Homology (1839-48). — VIII. Descriptive chemistry (1831-50). The first physicochemical investigations (KOPP, 1841). — IX. Radical theory (cont.). Type theory of WILLIAMSON and GERHARDT (1849-54). — X Multiple and mixed types, etc. Karlsruhe meeting, 1860. — XI. Descriptive chemistry, 1851-60. — XII. Quadrivalence of carbon. KÉKULÉ and COUPER on the linkings of the atoms. Structure of organic compounds, 1859-65. Unsaturated compounds. — XIII. Isomerism, 1858-65; Constitution of simple organic compounds. KOLBE's opposition to the structure theory. BLOMSTRAND's « Chemie der Jetztzeit », BERTHELOT. — XIV. KÉKULÉ's benzine theory; Theory of aromatic compounds, 1865-90. — XV. Constitution of naphthalene, anthracene, phenanthrene, pyridine and quinoline. — XVI. Stereochemistry. — XVII. Synthetic methods. — XVIII. Descriptive chemistry since 1860. — XIX. Tautomerism, desmotropism, pseudo-acids and pseudo-bases, etc. — XX. Stereochemistry since 1887. — XXI. Extension of the notion of aromatic compounds. Benzine theory since 1890. New views on unsaturated compounds. — XXII. Aniline colours. Relations between colour and constitution. Chromoisomerism. Fluorescence. New ideas on valence. — XXIII. Biochemistry. Chlorophyll, hemoglobine, enzymes, fermentations. Photochemistry. — XXIV. Physico-chemical methods. Relation between chemical constitution and physical, physiological, pharmacodynamical properties. Artificial synthetic drugs. Nomenclature. — XXV. Conclusion: a rapid survey of the whole development showing the relative importance of the different schools.

Of course I realise that such a telegraphic summary as the one I have just outlined will be of no use to those unfamiliar with this wonderful development, but then the book is meant only for trained chemists. In these days of international turmoil, it is more difficult than ever to judge impartially the works of the scientists of many nations. How impartial is the author of this book? EDV. HJELT is (or was at the time of writing) professor and vice-chancellor of the University of Helsingfors. His book gave me an impression of great fairness; besides it was almost ready when the war broke out, the writer being then in Germany. On the other hand it is clear that his sources of information are overwhelmingly German. In conclusion, I believe that this book should be translated into English but that

advantage should be taken of this opportunity to check his statements and to add notes completing the text on the basis of French, English, Italian and American documents. This is less a criticism than an indirect eulogy of HJELT's book ; as it is, it is already so good that it deserves to be treated in the same way that LADENBURG's history was dealt with by A. COLSON. However fair a man may be, it seems impossible that a history based chiefly on documents from one country be equally complete with regard to the other countries and give them full credit. G. S.

Letts, E. A. — *Some fundamental problems in chemistry old and new*, XIII + 235 p., 44 fig. London, CONSTABLE, 1914.

This book is of a kind of its own ; neither historical, nor systematic, neither philosophic, nor popular. It is divided into two main parts entitled : the older chemistry, the newer chemistry, but the first one deals with a good number of new chemical facts too and is much shorter. The truth is that the author has no historical training, no idea of historical accuracy, no real interest in history. His « newer chemistry » consists of the effects of electrical discharges in high vacua, radioactivity, LOCKYER's theory of inorganic evolution and ARRHENIUS's cosmological views. Much of this is uncritical. Tremendously interested in RAMSAY's « transmutations » and the other revolutionary discoveries of our times, he has tried to compare them to the views of the ancients on the nature of matter. This comparison suggests to him the extraordinary conclusion that « even in science history may repeat itself ». The first part of his book is devoted to this enquiry : it is interesting but unsystematic and uncritical. It is divided as follows : I. Ancient theories regarding the nature of matter and more recent theories as to the nature of energy. — II. The atomic theory and atomic weights. — III-IV. The periodic law and the inert elements.

Briefly, an entertaining book, useful to the discriminating and wary reader but dangerous both for the chemist who does not know history and for the historian who has no scientific experience.

G. S.

Julius Ruska. — *Methodik des mineralogisch-geologischen Unterricht*, VIII + 520 S , 35 Textabb., 1 Taf., Stuttgart, F. ENKE, 1920.

Excellent contribution to the *organization* (*Isis*, I, 195) of mineralogy and geology. It is the more welcome that : 1° the methodology of these sciences has received thus far but little attention ; 2° the

author being chiefly a mineralogist, has been able to lay more stress on the mineralogical side of geology than is generally done.

The book is built in the following way : I. General methodology. — II. Mineralogy and geology, as natural history (methodology of the elementary grade). — III. Mineralogy and geology in connection with the teaching of chemistry (methodology of the intermediate grade). — IV. Mineralogy and geology as an independent whole with autonomous methods (methodology of the advanced grade). — V. Auxiliary means of teaching. — VI. Preparation and further development of the teacher. — VII. Present and future of teaching. — Index.

The three first chapters of the first part are of special interest to us : the first is an outline of the history of mineralogy, the second an outline of the history of geology, and in the third RUSKA insists upon the importance of the teaching of the history of science from the pure methodological point of view. The historical outlines of the two first chapters are so terribly condensed that their only value to us lies in the information on Arabic science. We asked ourselves indeed : how much of Arabic science would RUSKA include in such brief outlines? I shall not insist on the two following parts (methodology of the elementary and intermediate grades) except to say that it is very pleasant to read RUSKA's simple, concrete and clear explanations as to how to teach the rudiments. It is all very vivid and full of common sense. The structure of the fourth part is as follows : 1. Generalities. — 2. General mineralogy : forms of minerals (with short history); crystallographic exercises; crystallographic *vs.* mathematic teaching; physical properties; chemical properties. — 3. Special mineralogy. — 4. Petrography. — 5 and 6. General geology : cosmologic point of view; main subdivisions; the earth as a planet; geophysics and geochemistry; internal forces (continental liftings and sinkings, seismology, volcanology); external forces acting upon the lithosphere; biologic geology; transition to the study of geologic formations. — 7. Geologic formations. — 8. Regional geology. — In the fifth part (auxiliary means), RUSKA deals with such topics as the organization of geologic and mineralogic collections, the selection of specimens and models, maps and profiles, books, etc.

This book should be carefully read by all persons engaged in the teaching of geology and mineralogy. *It should be promptly translated into English.*

JULIUS RUSKA is professor both at the Gymnasium and at the University of Heidelberg. He is not simply a mineralogist, but also one of the foremost students of Arabic science. As such he has already collaborated in *Isis* and I much hope that *Isis* will have the honour to publish further contributions of his. G. S.

Hélène Metzger. — *La genèse de la Science des Cristaux*, 248 pages (225×140). Paris, Félix Alcan, 1918.

Tandis que les spécialistes font en général naître la science des cristaux avec les travaux de Haüy, ne retenant guère parmi ses devanciers que Romé de l'Isle (découverte de l'invariabilité des angles dièdres), Mlle Metzger s'est au contraire proposée de rechercher les ébauches successives qui ont permis la composition du tableau de maître dressé à l'aube du XIXe siècle par le « fondateur de la cristallographie ».

C'est dans le grand courant de curiosité qui prit naissance vers le milieu du XVIIe, et dont Descartes avait donné la méthode et la formule, qu'il faut chercher l'origine de la science des cristaux. D'abord quelque peu confuse, celle-ci se dégage peu à peu de la minéralogie, avec les travaux de Sténon (l'accroissement se fait par juxtaposition suivant certains plans), de Bartholin (double réfraction du spath d'Islande), Bourguet (rapprochement des cristallisations naturelles des cristaux obtenus dans les laboratoires), Romé de l'Isle (invariabilité des dièdres), Werner (classification basée sur les caractères extérieurs).

En même temps que se poursuit cette évolution, la cristallographie se détache peu à peu de l'étude des êtres vivants. Pour Tournefort, les pierres, par analogie avec les coraux, étaient des végétaux, se nourrissaient comme les plantes, et se reproduisaient par graines. Tout au contraire, quelques années plus tard, Bourguet cherche l'explication des cristaux dans la loi de la gravitation universelle, et Buffon, avec sa théorie des molécules organiques, base en somme la théorie de la vie sur celle de la cristallisation ; De Lamétherie va plus loin encore et pense que la vie n'est qu'un cas particulier de la cristallisation générale de la matière.

La théorie de la cristallisation s'est évidemment ainsi séparée des théories biologiques, mais elle s'est en même temps tellement éloignée de la nature que, par réaction, fleurissent les travaux des descripteurs qui observent, qui mesurent, qui classent rationnellement.

Enfin, par une évolution parallèle, la cristallographie se dégage des sciences physiques. Il y a lieu de retenir ici surtout les travaux de l'Académie de Florence, de Mairan (cristallisation de la glace), de Rouelle (classification des sels d'après leur forme cristalline), de Baumé, Lavoisier, Nicolas Leblanc, qui prépare la voie sur laquelle s'engagera Mitscherlich, et de Romé de l'Isle.

Documentation extrêmement abondante, et que ne laissent pas soupçonner les quelques noms rappelés ici. Et sans aridité aucune.

C'est que Mlle Metzger s'est élevée au-dessus de ce que pouvait avoir de particulariste un tel sujet en rattachant, dans ses grandes lignes, l'histoire de la science des cristaux à l'histoire générale de l'humanité ;

en établissant qu'une théorie ne peut s'imposer à une époque qu'à la condition de se développer sur la route où la pousse la marche de la société; et que réciproquement, les opinions et les méthodes qui naissent en marge du courant actuel de la pensée, sont définitivement ou provisoirement vouées à l'oubli : la postérité les découvrira peut-être un jour avec admiration, mais elles seront restées sans action sur l'ensemble de leurs contemporains. — D'où découle pour l'historien de la science cette règle très judicieuse : il doit s'intéresser davantage à la société qu'à l'individu. LÉON GUINET.

Leonard Eugene Dickson. *History of the theory of numbers*, vol. I : Divisibility and Primality, XII+486 p. Carnegie Institution of Washington (No. 256), 1919.

The author of this work states in his preface that it represents the labour of seven years; and the only wonder is that such a stupendous task could have been completed in such a relatively short time. Rare old books and manuscripts, countless numbers of periodicals, as well as modern publications have yielded their quota; whilst all the most noteworthy libraries seem positively to have been turned inside out so that nothing of any value on the subject of the theory of numbers should have been missed. Nor is this all; rather than miss something which might be more important than its face-value, even little odds and ends have been included. For each one of these bits of information a reference is given to the source from which it has been taken; whilst in many cases, practically all the really important cases, a skeleton of the working has been given, which should stimulate developments. Prof. DICKSON'S own contributions find a place in most chapters, but it is easy to see where his interests mostly lie, namely, in the theory of congruences, especially those of higher order. To instance the completeness of the work, I looked for what is hardly more than a « puzzle », namely : — Take the ten digits and from them form three numbers, one of which is the product of the other two. I found one of the solutions on p. 463, with a reference in the footnotes to *L'Intermédiaire des mathématiques*, 19, 1912, 26-7, 187, where in all probability the other solution may be found by anyone who requires it. The author's preface, a synopsis of the contents in some 6,000 words, might well by itself stand for a short history of the subject suited to the requirements of the ordinary reader.

Naturally the task of the reviewer is just as stupendous, and well-nigh impossible. Almost all he can do besides the generalities written above is to give the table of contents, and make remarks on a few things that have caught his eye, or attracted his interest on account of

their relation to his own study. One has to be content with something little more than a very incomplete index.

Chap. I deals with Perfect and Amicable Numbers and developments from these. Here we read that the consideration of perfect numbers dates back to EUCLID, who gave $2^n p$ as a perfect number, where p is a prime and equal to $1+2+4+\ldots+2^n$. On p. 12, we learn that it was the consideration of perfect numbers that drove FERMAT to the invention of the theorem that usually goes under his name in text-books of Algebra. On p. 30, the author gives his own simple direct proof that all even perfect numbers are of EUCLID's type. On p. 42, we have an account in somewhat full detail of EULER's researches on amicable numbers of certain forms. There is a small point that is very interesting from another historical point of view, that of the invention of the sign for integration; EULER used $\int m$ as the symbol for the sum of all the divisors of m, which would seem to corroborate the view that this sign was not specially invented by LEIBNIZ, but was a mere abbreviation for *summa omnium*, the initial letter being written in its customary form at that time. In Chapt. II-VI, we have :—Formulas for the number and sum of divisors, problems of FERMAT and WALLIS; FERMAT's and WILSON's theorems, generalizations and converses; symmetric functions of $1, 2, \ldots p-1$, modulo p (it does not seem to have occurred to any of the great workers after FERMAT to try and find FERMAT's own proof by following the line of thought that is involved in figurate numbers, and so obtaining a proof by induction); Residue of

$$\frac{(u^{p-1}-1)}{p}$$

modulo p : EULER's Φ-function, generalizations, FAREY series : Periodic decimal fractions; periodic fractions; factors of $10^n \pm 1$; respectively. Chapt. VII, VIII occupy 80 p., dealing with the highly important subjects of primitive roots, congruences and GALOIS imaginaries. Chapt. IX-XIV treat of :—Divisibility of factorials and multinominal coefficients; Sum and number of divisors; Miscellaneous theorems on divisibility, G.C.M., and L.C.M.; Criteria for divisibility by a given number; Factor tables, lists of primes; Methods of factoring. Chapt. XV gives an account of the FERMAT Numbers, $2^{2^n}+1$, connected with which is GAUSS' Problem of the construction of a regular n-gon; of this problem a discussion is promised in a later volume under the heading of the Roots of Unity. Chapt. XVI deals with the factors of $a^n \pm b^n$; while in Chapt. XVII, under the heading :— Recurring Series; LUCAS' u_n, v_n; we have an important section of references to work that has been done on the algebraic theory of such series, the connection between these and finite difference equations being noted; nothing however seems to have been noted of the connection between both of

these and certain types of continued fractions. Chapt. XVIII deals with the Theory of Prime Numbers, most of it being concerned with the plenitude of primes and their position; a full account is given of the many attempts to solve GOLDBACH's theorem that every even number is the sum of two prime numbers; also there is a long list of references to tests for primality. Chapt. XIX is concerned with Inversion of Functions, MÖBIUS' Function, numerical integrals and derivatives; while Chapt. XX gives many curious properties of the digits of numbers. The volume ends with two full and useful indices, an author-index, arranged in chapters, and a subject-index.

We look forward with pleasant expectation to the next volume.

(*University, Manchester*). J. M. CHILD.

Jules Sageret. — *La vague mystique*, 180 p. (185×120). Paris, E. FLAMMARION; Bibl. de culture générale, 1920. [3 fr.]

La philosophie contemporaine semblait, avant la guerre, avoir comme caractère dominant un anti-intellectualisme très vif. Méfiance à l'égard de la science, place de plus en plus grande faite à l'inconscient, à l'instinct considéré comme indépendant du réflexe pur, concept de l'évolution s'appliquant à la raison elle-même, d'où convention et mobilité dans nos constructions scientifiques, tel semblait être le mouvement d'idées recueillant le plus d'adeptes.

M SAGERET entend précisément par « mysticisme », « tout ce qui, dans l'ordre de la pensée, est en dehors de la méthode et de la connaissance scientifique », et son livre, écrit avant la guerre, est une réaction contre ce mysticisme. Il représente, beaucoup plus qu'une critique des systèmes de W. OSTWALD, P. DUHEM, BERGSON, W. JAMES et E. BOUTROUX, une profession de foi scientiste, faite suivant une méthode d'exposition qui rappelle beaucoup la manière de LE DANTEC.

Les deux premiers chapitres sont d'excellente vulgarisation. L'auteur définit d'une part l'attitude du mysticisme, d'autre part celle de la méthode scientifique, et ce lui est occasion d'écrire de bonnes pages, de lecture très facile, sur le langage, sur la raison considérée comme un réservoir de propositions initiales et faisant, comme telle, partie intégrante de la science ; sur la relativité et la faillite de la science.

Dans les chapitres suivants sont examinés quelques points particuliers de la philosophie de H. POINCARÉ, et de celle des penseurs dont nous venons de rappeler les noms. La réalisation ne répond malheureusement pas au but poursuivi. Il eût fallu, pour chacun d'eux, non seulement exposer ce qui constitue la clef de voûte de l'édifice, mais donner une idée d'ensemble de la doctrine, et de courts articles n'y suffisent point. C'est l'écueil auquel se heurte la vulgarisation sur un modèle réduit.

Mais si l'on juge ce petit livre au point de vue du consommateur pour lequel il est écrit—et le jugement du consommateur a bien sa valeur,— il est fort possible que ce soit un bon livre qui permettra à beaucoup d'entrer dans un domaine qui leur est généralement fermé, un livre qui leur fera même éprouver le désir d'y pénétrer plus à fond, au risque peut-être de devenir des « mystiques ». Mais s'ils relisent alors le livre initiateur, ils sentiront toute la valeur de la morale du scientisme, que M. SAGERET examine dans son dernier chapitre

LÉON GUINET.

Butler, Hiram E. [1841-]. — *Solar Biology*. A scientific method of delineating character, diagnosing disease, determining mental, physical and business qualifications, conjugal adaptability, etc., from date of birth. Twenty third edition. With illustrations [and portrait of the author], XL + 228 + 206 p. Esoteric Publishing Co. Applegate, California 1920.

It is out of the question to review, or even to mention, in *Isis* all the books and pamphlets dealing with occult sciences. It would take an immense amount of space and would be of very little use. Yet an exception must be made once in a while, be it only to remind the scientist of the enormous amount of ignorance and superstition which is still surrounding him. I assume that most publications of the present kind belong rather to the chapbook literature, but this is a large volume, well printed, of a dignified appearance and selling for five dollars. A special notice (on p. XII) says : « We wish to ask our friends to do us the kindness of letting us know of any person selling Solar Biology for less than the regular price ($ 5). We feel that it is an important work and really worth manyfold more than the price asked for it .. » — Now the distressing fact is not that such a book should be written, — for it takes but one fool to do it, — but that there be enough people ready to pay $ 5 for it. Mind you, this is the twenty third edition ! (I see that it was copyrighted in 1887).

The book is built in the following way. There are three prefaces : one by the editor, JOHN LATHAM; another by the author; the third one also by the author, being a special notice to astronomers and astrologers. Then come seven diagrams : The seven vital or creative principles; the Sun's zodiac; the Solar man; the Solar system; the earth's zodiac; the Solar woman; the future temple as seen by JOHN. The Introduction deals with the *Bible history of Solar biology* : I. Preliminary philosophy. Involution and evolution. Man's triune nature. The law of soul marriage. The selection of partners in marriage. — II. The mechanism of Solar biology... — III. The twelve signs or functions of the zodiac. — IV. Polarity and quantity.

— V. Courage and consolation to all. The power and importance of breath; each of VI-XVII deals with one the signs of the zodiac. — XVIII. The planets. Order and harmony of the seven vital functions. — XIX to XXIV deal respectively with Mercury, Venus, Mars, Jupiter, Saturn and Uranus. — XXV-XXVI with various moral questions and sexual life. — XXVII. Directions for reading character. There is also, as in any respectable scientific treatise, an Appendix in which are considered topics as these; fragments of a lost planet, powers and principalities of the air;... the planet Lucifer, etc... Lastly, there is a large number of tables giving the positions of the moon and planets from 1820 to 1921, Greenwich mean time (two pages for each year).

Glancing through such a book gives one the same uncomfortable feeling as visiting an insane asylum and talking with a few of the inmates. Indeed it is worse, — for each of the inmates represents but himself, while I cannot read this book without seeing before me the thousands of men and women who believe in it. These people are not poor and totally uneducated. I suppose that a great majority of the buyers are society women who have had in a college or a finishing school just enough scientific education to make others and themselves believe that they know something. What a pity that one cannot find out who the readers are, from which schools and colleges they come! It is safe to assume however that their training was literary rather than scientific. Apropos of this book, I read in a paper some days ago that a business man had recently « made » a million dollars or so manufacturing « ouija » boards (that is boards, on which the alphabet and various signs are written, used with a planchette to obtain mediumistic messages). One may question the honesty of such business, but at least this much can be said in its favour : while other natural resources as timber, coal and oil exist only in limited quantities, human folly is inexhaustible. The man who made the ouija boards did not impair the chances of the one who wrote the Solar Biology; on the contrary.

Why should we expect men to behave wisely in peace or war, when superstition is still rampant everywhere? When we speak of the progress of science we forget but too often that this progress interests only a very small minority; the diffusion of science is hardly begun.

G. S.

Ninth Critical Bibliography

of the History, Philosophy and Organization of Science and of the History of Civilization

(to August 1920, but very incomplete)

This ninth critical bibliography is very incomplete, because there are still a great number of publications (especially German) which I have not been able to see. I have in hand more than 2,000 notes which I will publish (or not) as soon as I am able to check them.

This bibliography contains about 365 notes. It includes the titles of all the papers and reviews, however short, published in *Isis*, No. 6 to 9. It thus forms a table of contents to these numbers.

Some of the notes of the present bibliography have been contributed by Charles Singer and L. C. Karpinski (Ann Arbor, Mich.).

I hope to be able to publish in the next bibliography a list of the periodical publications which are systematically read by the Editor.

The arrangement and leading principles of our bibliography are explained in *Isis*, III. p. 159-171. It is well to repeat once more that Part I is the fundamental classification, by centuries. Part II and III contain only such items which could not be included in Part I because they deal with periods longer than two centuries.

A summary table of the nine first critical bibliographies will be found at the end of the present one.

George Sarton.

Cambridge, Mass. Sept. 18, 1920.
24 Agassiz str.

PART I

—

Fundamental Classification (centurial)

S. IX A. C.

Wright, Jonathan. The white man's magic in HOMER. *Scientific Monthly*, IX, p 550-560. Lancaster, Pa. 1919. 1818

S. V A. C.

Cajori, Florian. The purpose of ZENO's arguments on motion. *Isis*, III, p. 7-20, 1920. 1818

Introduction. Ancient criticism of ZENO's arguments. Modern criticism: 1. ZENO's arguments considered sophistry. 2. ZENO's arguments considered valid: *a*) COUSIN's interpretation; *b*) GROTE's interpretation; *c*) TANNERY's interpretation. G. S.

Jourdain. Philip E. B. The Flying Arrow. An anachronism, *Mind*, XXV, p. 42-55. Aberdeen 1916.

See *Isis*, III p. 277-278 (JOURDAIN). 1819

S. IV A. C.

Aristotelis Meteorologicorum Libri Quattuor. Recensuit indicem verborum addidit F. H. FOBES, XLVIII + 235 p. Cantabrigiae Mass. 1919. 1818

See *Isis* III, p. 278-279 (SARTON).

Schmidt, C. W. Der Entwicklungsbegriff in der aristotelischen Naturphilosophie *Archiv. f. Gesch. d. Naturw.*, VIII, p. 49-65. Leipzig 1917. 1818

Wundt, Max [1879-]. PLATONS Leben und Werk, 174 S. Iena, DIEDERICHS, 1914. 1818

After a little essay on PLATO and the problem of culture and a sketch of SOCRATES, the author treats simultaneously of PLATO's life and work, which implies a chronological classification of his writings. The account is simple and clear and followed by a conclusion on PLATO and the development of culture. MAX WUNDT is a son of WILHELM WUNDT and has published previously: Gesch. d. griech. Ethik 1908-1911; GOETHES Wilhelm Meister u. d. Entwicklung des modernen Lebensideals 1913. G. S.

S. III A. C.

Senart, E. Un nouvel édit d'Aśoka à Maski. *Journal Asiatique*, VII, p. 425-442. Paris 1916. 1819

Apropos of the publication by Râo Sahib H. KRISHNA SASTRI of the new Asokan edict of Maski (Hyderabad Archaeol. Series, 1) 1915. G. S.

Zeuthen, H. G. Sur les définitions d'EUCLIDE. *Scientia*, vol. 24, p. 257-269. Bologna 1918. 1818

S. I A.C.

Calder, W. M. The Date of the Nativity. *Discovery*, I, p. 100-103. London 1920. 1818

The birth of CHRIST must be dated earlier than 6 B. C.; several convergent lines point to a date 9-7, and probably 8 B. C. G. S.

Conway, R. S. VERGIL among the Prophets. *Discovery*, I, p. 138-141. London 1920. 1818

Sargeaunt, G. The trees, shrubs and plants of VIRGIL, VII+149 p. Oxford, BLACKWELL 1920. 1818

The works of VIRGIL are botanically important as being one of our very few sources between THEOPHRASTUS (IV^th c. B. C.) and DIOSCORIDES (I^st cent. C. E.). There is no author of classical antiquity on whom more has been written than VIRGIL, there is none whose text is so well vouched for by early and numerous MSS. It is thus very remarkable that anything new and useful has to be said about him, yet by going direct to nature, Mr. SARGEAUNT has found much to say that is both new and interesting and he has said it in the least possible compass. The book is instinct with the love of nature and of the classics and is a real and very pleasant addition to the history of botany. C. S.

S. I

Horwitz, Hugo Theodor. Ueber ein neueres deutsches Reichspatent und eine Konstruktion von HERON von Alexandria. *Archiv für Gesch. d. Naturw.*, VIII, p. 134-139. Leipzig 1918. 1818

The German Patent 244-475 (1908 July 28) for a lubricating device is really a rediscovery of a Heronian idea. G. S.

S. II

Mooney, Joseph J. HOSIDIUS GETA's Tragedy « Medea ». A Vergilian cento. Latin text with metrical translation, 96 p. Birmingham, CORNISH, 1919. 1818

Curious work throwing light on ancient Roman magic. C. S.

Peters, Christian H. F. [-1890] and **Knobel, Edward Ball.** PTOLEMY's Catalogue of Stars, a revision of the Almagest, 207 p. in-4°, 4 pl. Washington, CARNEGIE Institution, 1915. 1818

See *Isis*, II, p. 401 (SARTON).

Schütte, Gudmund. PTOLEMY's Maps of Northern Europe. A reconstruction of the prototypes, XVI+150+XXXIII p., 31 maps. Copenhagen, HAGERUP, 1917. 1818

See *Isis*, III, p. 422-423, (SARTON).

S. IV

Schiff, Julius. Erwiderung auf EDM. O. v. LIPPMANN's Bemerkung zur Geschichte des Quecksilbers und der Quecksilberverbindungen. *Archiv f. Gesch. d. Naturw.*, VII, p. 310-312. Leipzig 1916. 1818

Apropos of a passage of AUSONIUS. See *Isis*, III, p. 95.

S. VII

Browne, G. F. The Venerable BEDE, his Life and Writings, XV + 327 p. illustr. London, Society for the Promotion of Christian Knowledge, 1919. 1818

A popular but scholarly and useful account of the man who was perhaps the most important writer of the Dark Ages, with a valuable chapter on his scientific works. C. S.

Lammens, Henri. L'attitude de l'Islam primitif en face des arts figurés. *Journal Asiatique*, VI., p. 239-279. Paris 1915. 1818

Communication faite au III^e^ Congrès archéologique de Rome, octobre 1913, sous un titre légèrement différent. La thèse de l'auteur c'est que l'interdiction des images chez les musulmans n'est probablement pas antérieure au II^e^ siècle de l'Hégire. MAHOMET n'y a point songé. G. S.

S. VIII

Pruefer, C. und Meyerhof, M. Die Augenheilkunde des JUHANNÀ b. MÂSAWAIH (777-857 n. Chr.). *Der Islam*, Bd. VI, p. 217-268, Strassburg 1916; cfr. also *ibid.*, VII., p. 108. 1818

Contains a complete analysis of the Book of the Eye, known under the name « The Disorder of the Eye », the oldest systematic textbook of ophthalmology in the Arabic literature. Followed by a critical study of the ophthalmological part of the Syrian Book of Medicines published in 1913 by E. A. WALLIS BUDGE. G. S.

Willoughby, L. A. England's « Peaceful Penetration » of Germany in the Middle Ages. *Discovery*, I, p. 46-48, London 1920. 1818

Deals with the Anglo-Saxon influences to which Germany was submitted in the VIII and IX^th^ cent., à propos of the work of WILHELM BRAUNE of Heidelberg. G. S.

S. IX

Ruska, Julius. Zur ältesten arabischen Algebra und Rechenkunst. *Sitzungsberichte der Heidelberger Akad. d. Wissensch., Philos.-hist.klasse*, J. 1917. 125 S. Heidelberg, WINTER, 1917. 1818

Deals chiefly with AL KHOWARIZMÎ; analyzed under *Islam*. G. S.

S. X

Hauber, A. (†). Zur Verbreitung des Astronomen ṢŪFĪ [903-986]. *Der Islam*, VIII, p. 48-54, Strassburg 1918. 1818

Schoy, Carl. Das 20. Kapitel der grossen Ḥâkemitischen Tafeln des Ibn Jûnis : Ueber die Berechnung des Azimuts aus der Höhe und der Höhe aus dem Azimut. *Ann. d. Hydr. usw.*, 48. Jahrg. (1920) Heft 3, p. 97-112. 1918

Literal translation of the XXth chapter of the Hakemite tables with short commentary. G. S.

S. XI

Dubreuil-Chambardel, Louis. Les médecins dans l'ouest de la France aux XI^{e} et XII^{e} siècles. XII + 292 p. Paris, Société française d'Histoire de la Médecine, 1914. 1918

See *Isis* III, 279-280 (Singer).

S. XII

Karpinski, Louis C. Two twelfth century algorisms. *Isis*, III, p 396-413, 1921. 1918

Publication with notes and translation of two early Latin algorisms, both in the British Museum : (1) Royal MS. 15 B. IX, f. 77^{B}; (2) Egerton MS. 2261, f. 225^{B}-227^{B}. These algorisms are compared with other early algorisms and a bibliography of the subject is included. G. S.

Langlois, Ch. V. Travaux de Ch. H. Haskins sur la littérature scientifique en latin au XII^{e} siècle. *Journal des Savants*, XVII, p. 57-73. Paris 1919. 1918

Etude d'ensemble sur dix essais de Ch. H. Haskins, publiés dans divers recueils de 1909 à 1918. G. S.

Pardi, Guiseppe. Quando fu composta la Geografia d'Edrisi. *Rivista geografica italiana*, XXIV, p. 380-382. Firenze 1917. 1918

Pardi argues that *al Rojari* could not be written while Roger of Sicily lived because it does not mention the great Umbrian city of Spoleto : Spoleto was destroyed by Frederic Barbarossa in July 1154 ; Roger died in Febr. of same year. G. S.

Singer, Charles. Daniel of Morley, an English philosopher of the XIIth century. *Isis*, III, 263-269, 1920. 1918

Essay suggested by Sudhoff's publication of Morley's Liber de naturis inferiorum et superiorum, 1917, with a bibliography. G. S.

Sudhoff, Karl. Daniel von Morley. Liber de naturis inferiorum et superiorum nach der Handschrift Cod. Arundel 377 des Britischen Museums zum Abdruck gebracht. *Archiv f. Gesch. d. Naturw.*, VIII, p. 1-40, 1 Taf. Leipzig 1917. 1918

See Charles Singer, *Isis*, III, p. 263-269.

S. XIII

Dreyer, J. L. E. On the original form of the Alfonsine tables. *Monthly notices of the R. Astron. Soc.*, vol. 80, p. 243-262, 1920. 1918

Based upon the study of 19 codices and of the early editions (ed. princeps, Venice, 1483). G. S.

Gauchet, L. Note sur la trigonométrie sphérique de Kouo Cheou-King [1231-1316]. *T'oung Pao*, XVIII, p. 151-174. Leide 1917. 1818

Little, A. G. Studies in English Franciscan history, x + 248 p. Manchester, University Press, 1917. 1818

See *Isis*, III, p. 280-282 (Singer).

McClenon, R. B. Leonard of Pisa and his Liber Quadratorum, *American Mathematical Monthly*, XXVI, p. 1-8, 1919. 1818

An excellent account, with summary of the fundamental propositions, of this interesting work by Leonard of Pisa, including translation of some of the propositions. L. C. K.

Philipp, Karl. Beiträge zur Kulturgeschichte Persiens nach Sa'dî. *Der Islam*, VII, p. 92 101, 299 306. Strassburg 1917. 1818

I. Waffen und Heerwesen. II. Das Recht und seine Vertreter. III. Aerzte, Krankheiten und Heilmittel. G. S.

Seybold, C. F. Al-Abharî's († 663 = 1265) Isâgugî und al-Fanârî's († 834 = 1431) Kommentar dazu: Bemerkungen zu Gothanus 1178 und Enzyklopädie des Islam I, 74 a. *Der Islam*, Bd. 9, 112-115. Strassburg 1919. 1818

Al-Abharî: philosopher, mathematician, astronomer. See H. Suter, Die Mathematiker..., p. 141, 145, 219 Suter gives another date of death, but 1265 is correct. The Isagoge is a book of logic. Al-Abharî wrote also five (not 3) astronomical papers. G. S.

Underhill, Evelyn. Jacopone da Todi. Poet and Mystic (1228-1306). A spiritual biography. With a selection from the spiritual songs, the Italian text translated into English verse by Mrs. Theodore Beck, xi + 521 p., 2 illustr. London, J. M. Dent, 1919. 1818

The text of the *Laude* is the one established by Dr. Giovanni Ferri, who has corrected the proofs of this new selection. To the biography (p. 3-248) and the select *Laude* are added a bibliography, a note on the MSS and an attempt to classify the poems in 4 chronological groups. G. S.

S. XIV

Ruska, Julius. Arabische Texte über das Fingerrechnen. *Der Islam*, Bd. X, p. 87-119. Berlin 1920. 1818

Edition and translation of Ms. Gotha A. 1495, a didactic poem by Abu'l-Ḥasan 'Alî ibn al-Maġribî with commentary by Muḥji ad-dîn 'Abd al Kâdir b. Alî b. Sa'bân as-Sôfî. The commentary dates of the last third of the xivth cent., the poem of the xivth or perhaps of the xiiith cent. G. S.

S. XV

Almagià, Roberto. Il mappemondo di Albertin de Virga. *Rivista geografica ital.*, XXI, p. 92-96. Firenze 1914. 1818

Apropos of F. R. v. Wieser. Die Weltkarte des Albertin de Virga aus dem Anfange des xv. Jahrh. in der Sammlung Figdor in Wien. Innsbruck, Schwick, 1912. G. S.

Baratta, Mario. La carta nautica di Albino Canepa (1480). *Boll. R. Soc. geogr. ital.*, IV, p. 721-746, 1 tav. Roma 1915. 1818

Bensaude, Joaquim. Histoire de la science nautique portugaise, 110 p. Genève, Kundig, 1917. 1818

See *Isis*, III, p. 424-426 (Sarton).

Massalongo, Roberto. Alessandro Benedetti [1440-1525] e la medicina veneta del quattrocento. *Atti del R. Ist. Veneto di scienze...*, t. 76, parte 2*a*, p. 197-259. Venezia 1916-1917. 1818

[Sarton, George]. Gutenberg Museum und Gesellschaft (Mainz), *Isis*, II, p. 399-400, 1919. 1818

Short note to explain the aims of this society with list of its most important publications. G. S.

Ulugh Beg. Catalogue of Stars. Revised from all Persian MSS. existing in Great Britain, with a vocabulary of Persian and Arabic words by Edward Ball Knobel, 109 p. in-4°. Washington, Carnegie Institution, 1917. 1818

See *Isis*, II, 413-415 (Sarton).

Beltrami, Luca. Documenti e memorie riguardanti la vita e le opere di Leonardo da Vinci in ordine cronologico, XII + 222 p., 2 ill. Milano, Treves, 1919. 1818

Many chronological accounts of Leonardo's life and works have already been published but Beltrami is the first to offer us a complete collection in chronological order of the documents themselves quoted in extenso. They are 263 in number and range from 1451 to 1570; most of them are extracts from archives or from Leonardo's own MSS., but contemporary printed documents are also completely quoted, the longest extracts of the latter kind being of course those from Vasari's *Vite* and from Lomazzo's works (p. 182-206, on the basis of Solmi's excerpts, 1907). Beltrami has placed at the end a series of Renaissance poems mentioning Leonardo. An index completes this most useful collection. G. S.

Favaro, Antonio. Note Vinciane : I. La madre di Leonardo. — II. L. e Cecilia Gallerani. — III. Il compilatore del Trattato del moto e misura dell' acqua. — IV. Correzioni e cancellature nei Manoscritti Vinciani. *Atti del R. Istit. Veneto di scienze*, t. 79, parte 2*a*. Venezia 1920. 1818

Favaro, Antonio. Persone Vinciane. *Archivio di Storia della Scienza*, I, p. 313-323. Roma 1920. 1818

Persons to whom Leonardo da Vinci alludes in his writings. General remarks followed by 3 particular cases : 1) In Atl. 349 r., « Monsignore di Santa Gusta in Roma » = Gaspare Torrella, vescovo di Santa Giusta, Sardegna, dal 1494 al 1505 (?); 2) In Atl. 247 r., « Leonardo chremonese » = Leonardo de Antonii; 3) In S. K., II. 2, 75 v., « alessandro charissimo » = Alessandro Carissimi. G. S.

Venturi, Lionello. La Critica e l'Arte di Leonardo da Vinci (Publicazioni dello Istituto di Studii Vinciani in Roma, vol primo), VIII+206 p., 22 ill. Bologna, Zanichelli, 1919. 1818

This book deals exclusively with Leonardo the artist, but it will be indispensable to those who study Leonardo's ideas on perspective, light and shade and other subjects on the borderland of art and science. In the first part (La critica di L.), Venturi studies L.'s theories of art, comparing them with the theories, explicit or implicit, of his Italian predecessors and of his contemporaries. In the second part (L'arte di L.), he first makes a very complete review of the various theories entertained about L.'s art from Vasari to Sirèn. He then proceeds to explain his own conceptions; this last part contains a brief analysis of L.'s chief paintings. A well informed and penetrating study. G. S.

Verga, Ettore. La « Raccolta Vinciana » presso l'Archivio storico del comune di Milano. 1905-1919. *Archivio di Storia della Scienza*, I, p. 324-329. Roma 1920. 1818

S. XVI

Almagià, Roberto. Intorno ai primi saggi di carte sismiche. *Rivista geografica ital.*, XXI, p. 463-470. Firenze 1914. 1818

Apropos of maps, one relative to the earthquake of Nizza 1564, wrongly attributed to G. Gastaldi, the others to the earthquake of the M. Gargano, 1627. These are the first real seismological maps. G. S.

Almagià, Roberto. La cartografia dell' Italia nel Cinquecento con un saggio sulla cartografia del Piemonte. *Rivista geografica ital.*, XXI, p. 640-656; XXII, p. 1-26. Firenze 1914 1915. 1818

Almagià, Roberto. La cartografia del Lazio nel Cinquecento. *Riv. geograf. ital.*, XXIII, p. 25-44. Firenze 1916. 1818

Apropos of the fac-simile publication by Thomas Ashby of « Mappa della Campagna Romana del 1547 di Eup. Della Volpaja..., Roma 1914. G. S.

Baratta, Mario. Ricerche intorno a Giacomo Gastaldi. *Rivista geografica ital.*, XXI, p. 117-136, 373-379. Firenze 1914. 1818

Giac. Gastaldi from Villafranca, Piemonte was famous as a cartographer in Venice about the middle of sec. XVI. G. S.

Dreyer, J. L. E. The place of Tycho Brahe in the history of astronomy. *Scientia*. XXV, p. 177-185. Bologna 1919. 1818

Feldhaus, Franz M. Zur Geschichte der Messkette. *Geschichtsbl. f. Technik u. Industrie*, VI, 71-72, 1 Abb. Berlin 1919. 1818

Darmstaedter quotes as being the two first dates in the history of surveyors chains : 827 (Abd. al Mamum) and 1605 (Stevin). Both indications are incorrect. The surveyor's chain was first described and illustrated by Melchior Sebiz, Siben Bücher von dem Feldbau, p. 472. Strassburg 1579. G. S.

Garrison, Fielding H. In defense of Vesalius. *Bulletin of the Society of Medical History of Chicago*, p. 47-65. January 1916. 1818

Excellent summary of the Leonardo-Vesalius controversy. G. S.

Johannsen, Otto KASPAR BRUNNERS gründlicher Bericht des Büchsengiessens vom Jahre 1547. *Arch. für Gesch d. Naturw.*, VII, p. 165-184, 245-255, 313-323, 3 Abb. Leipzig 1916. 1818

Massalongo, Roberto. GIROLAMO FRACASTORO e la rinascenza della medicina in Italia. *Atti del R. Istit. Veneto d. scienze...*, LXXIV, parte 1a, p. I-LXII. Venezia 1914-1915. 1818

Nallino, Carlo A. Un mappamondo arabo disegnato nel 1579 da 'ALI IB N AHMAD AL-SHARAFÎ di Sfax, con una tavola in fototipia. *Boll. d. R. Soc. geogr. ital.*, V, p. 721-736. Roma 1916. 1818

Orta, Garcia da Colloquies on the Simples and Drugs of India. New edition edited and annotated by the Conde DE FICALHO, transl. with an introduction and notes by Sir CLEMENTS MARKHAM. XX + 509 p., 26 pl. London, SOTHERAN, 1913. 1818

See *Isis*, II, p. 415-418 (AGNES ARBER).

Pinelli, Giovanni Vincenzo [Napoli (?) — Padova, 1601]. Lettere di G. V. PINELLI. Bibliofilo del secolo XVI, pubblicate dal Prof. G. B. DE TONI (Spigolature Aldrovandiane, XVIII). *Archivio di Storia della Scienza*, I, p. 297-312. Roma 1920. 1818

Power, the late Miss Maura. An Irish astronomical tract based in part on a mediaeval Latin version of a work by MESSAHALAH, with preface, translation and commentary, XVII + 176 p., illustr. London, Irish Texts Society, 1914. 1818

A graduation thesis of unusual interest. Though mainly from MESSAHALAH there are other elements in it and the author draws on the Renaissance astronomers. On internal evidence we place the work somewhat later than Miss POWER, say the first half of the XVI^th cent. The early death of the gifted authoress is a real loss to learning. C. S.

Smith, David Eugene. Mathematical Problems in Relation to the History of Economics and Commerce. *American Mathematical Monthly*, XXIV, p. 221-223, 1917. 1818

Brief discussion of the significance of problems in early arithmetics in throwing light upon the commercial, industrial, and general business conditions in the time and place of origin of the problems. L. C. K.

Smith, the late W. F. RABELAIS in his Writings. VIII + 230 p. Cambridge, University Press, 1918. 1818

This work by an eminent RABELAIS specialist contains chapters on RABELAIS as physician and on plants mentioned by him. References both to the works of RABELAIS and to the *loci* in authors from whom he quotes are carefully recorded. C. S.

S. XVII

Ahrens, W. Die Originalluftpumpen OTTO VON GUERICKES. *Archiv f. Gesch. d. Naturw.*, VIII, p. 82-91, 4 Abb. Leipzig 1917. 1818

Berthold, G. Die Originalluftpumpe OTTO V. GUERICKES. Typus III. *Archiv f. Gesch. d. Naturw.*, VII, p. 426-427, Leipzig 1916. 1818

Bussey, W. H. Fermat's Method of Infinite Descent. *American Mathematical Monthly*, XXV, p. 333-337, 1918. 1818

The author shows that the process is « Mathematical Induction turned around » and applicable to any proof given by Mathematical Induction. L. C. K.

Cajori, Florian. Napier's logarithmic concept; a reply. *American Mathematical Monthly*, XXIII, p. 71-72, 1916. 1818

A discussion of a formulation in modern symbols corresponding to Napier's definition of a logarithm. L. C. K.

Cajori, Florian. Who was the First Inventor of the Calculus? *American Mathematical Monthly*, XXVI, p. 15-20, 1919. 1818

Critical review of Child's, « The Geometrical Lectures of Isaac Barrow », with rejection of the claims in behalf of Barrow as the inventor of the calculus. L. C. K.

Cajori, Florian. Oughtred's ideas and influence on the teaching of mathematics. *Monist*, XXV, p. 495-530. Chicago 1915. 1818

See *Isis*, III, p. 282 (Jourdain).

Cajori, Florian. The works of William Oughtred. *Monist*, XXV, p. 441-466. Chicago 1915. 1818

See *Isis*, III, p. 282-283 (Jourdain).

Child J. M. The Lectiones Geometricae of Isaac Barrow. *Monist*, XXVI, p. 251-267. Chicago 1916. 1818

See *Isis*, III, p. 283 (Jourdain).

Child, J. M. Did Fermat have a solution of the so-called Pellian equation? *Isis*, III, p. 255-262, 1920. 1818

Child shows that he *may* have had one, for he may have had sufficient knowledge of the theory of continued fractions for this purpose. Moreover Child proceeds to develop a solution of this equation *without* employing continued fractions. He gives good reasons to assume that Fermat used the same method. G. S.

Crucé, Emeric [v. 1590-1648] Le Nouveau Cynée, réimpression du texte original de 1623, avec introduction et traduction anglaise par Thomas Willing Balch, XXXI + 363 p. Philadelphie, Allen, Lane and Scott, 1909. 1818

See *Isis*, II, p. 418-421 (Sarton).

De Morgan, Augustus [1806-1871]. Essays on the life and work of Newton. Edited with notes and appendices by Philip E. B. Jourdain, XIV + 198 p. Chicago, Open Court Co., 1914. 1818

See *Isis*, III, 283-285 (Jourdain).

De Vrijer, M. J. A. Henricus Regius. Een « cartesiaansch » hoogleeraar aan de Utrechtsche Hoogeschool. Met portret. VIII + 222 + XXII bdz., 's Gravenhage. Martinus Nyhoff, 1917. 1818

A study of the life and thought of Henricus Regius, or Henrick De Roy

(Utrecht 1598- *ibidem* 1679), professor of philosophy at the University of Utrecht. A Cartesian in the sense that he was deeply influenced by DESCARTES, yet about 1640 he began to criticize the Cartesian philosophy; later after the apparent triumph of VOETIUS over DESCARTES in 1642, REGIUS assumed an intermediate position between both. This book contains a biography of REGIUS, a study of the philosophical teaching in Utrecht from 1638 to 1679, of REGIUS' thought, of REGIUS' correspondance with DESCARTES. G. S.

Evans, G. W. CAVALIERI's Theorem in his own words. *American Mathematical Monthly*, XXIV, p. 447-351, 1917. 1918

L. C. K.

Favaro, Antonio. GALILEO GALILEI, BENEDETTO CASTELLI e la scoperta delle fasi di Venere. *Archivio di Storia della Scienza*, I, p. 283-296. Roma 1920. 1918

A criticism of CAVERNI's prejudiced views on the subjet. G. S.

Georges-Berthier, Aug. [-1914]. Le mécanisme cartésien et la physiologie au XVII^e siècle. *Isis*, III, p. 21-58, 1920. 1918

Continuation of the memoir begun in vol. II, p. 37-89, with an obituary preface by EDMOND GOBLOT. AUG. GEORGES-BERTHIER died for France in 1914 at the age of 26! — The whole memoir is divided as follows: I. Introduction. — II. La physiologie cartésienne. — III. Le rôle historique de la physiologie cartésienne. Iatrochimistes et iatromécaniciens. — IV. Conclusion — An everlasting monument to the memory of our much lamented friend... G. S.

Hesz, Wilhelm. Ein kabbalistischer Einblattdruck naturwissenschaftlichen Gepräges [1617]. *Archiv f. Gesch. d. Naturw.*, VII, p. 115-128, 1 Taf. Leipzig 1916. 1918

Hobson, E. W. JOHN NAPIER and the invention of logarithms, 1614, 48 p. Cambridge, University Press, 1914. 1918

See *Isis*, III, p. 285-286 (JOURDAIN).

[Huygens, Christian.] La maison de CHRISTIAN HUYGENS. *Isis*, II, p. 394, 1919. 1918

Short note (7 lines) to announce the danger which HUYGENS's Dutch country seat, Hafwyck, is running. G. S.

Jourdain, Philip E. B. NEWTON's hypotheses of ether and of gravitation from 1672 to 1679, *Monist*, XXV, p. 79-106; *idem* from 1679 to 1693, *ibidem*, p. 234-254; *idem* from 1693 to 1726, *ibidem*, p. 418-440. Chicago 1915. 1918

See *Isis*, III, 286-289 (JOURDAIN).

Milhaud, Gaston. L'œuvre de DESCARTES pendant l'hiver 1619-1620. I. La méthode et la mathésis. — II. Les premiers travaux d'analyse et de géométrie. *Scientia*, XXIII, p. 1-8, 77-90. Bologna, 1918. 1918

Moritz, R. On NAPIER's fundamental theorem relating to right spherical triangles. *American mathematical monthly*, XXII, p. 220-222, 1915. 1818

Appreciation and exposition of NAPIER's rule for the circular parts of a right spherical triangle « as the most beautiful theorem in the whole field of elementary trigonometry ». L. C. K.

Nias, the late **J. B.** Dr JOHN RADCLIFFE [1650-1714], a sketch of his life with an account of his fellows and foundations, 147 p., illust. Oxford, CLARENDON Press, 1918. 1818

A biographical account of all those who have enjoyed the very large endowments left to the University of Oxford by the physician to Queen ANNE. It is a melancholy fact that until the second half of the XIXth century and with the exception of the work of the RADCLIFFE Observatory, these great funds were entirely unproductive so far as the advancement of science and learning was concerned. The beauty of this little volume and its pictures and the entertaining character of its biographical anecdotes cannot conceal this unfortunate record. C. S.

Peters, Hermann. LEIBNIZ als Chemiker. *Archiv f. Gesch. d. Naturw.*, VII, p. 85-108, 220-235, 275-287. Leipzig 1916. 1818

Vogel, Otto. CHRISTOPHER POLHEM und seine Beziehungen zum Harzer Berbau. *Beitr. zur Gesch. d. Technik u. Industrie*, V, p. 298-345, 35 Fig. Berlin 1913. 1818

CHRISTOPHER POLHEM (Wisby, Sweden 1661-1751), very prolific inventor and the greatest mining engineer of his time. Two portraits. G. S.

Wieleitner, H. Zur Erfindung des Zeichens ×. *Zeitschrift für math. u. naturw. Unterricht*, Bd. 51, p. 145-148. 1818

A complete account of the symbol introduced by OUGHTRED in 1631, or perhaps already in 1618 if the Appendix to WRIGHT's translation of NAPIER's Descriptio, was really written by him. Fac-simile of the text of 1631. G. S.

S. XVIII

Becker, Albert. Neues über PAUL « HEINRICH DIETRICH » Freiherrn von HOLBACH (1723-1789). *Archiv f. Gesch. d. Naturw.*, VII, p. 163-164. Leipzig 1916. 1818

[Bernoulli, Jacques. [1654-1705.] Le centenaire de la loi des grands nombres (1713). *Isis*, II, p. 395, 1919. 1818

Short note about the bicentenary of the posthumous publication of the *Ars conjectandi*. This centenary was celebrated by the Academy of Sciences of Saint Petersburg in December 1913. G. S.

Buck, Albert H. The Dawn of Modern Medicine. An account of the revival of the science and art of medicine which took place in Western Europe during the latter half of the XVIIIth century and the first part of the XIXth. XIX + 288 p., illustr. Yale University Press, New Haven, 1920. 1818

Cajori, Florian. Discussions of fluxions : from BERKELEY to WOODHOUSE. *American Mathematical Monthly*, XXIV, p. 145-154, 1917. 1818

Brief historical account of English XVIII^th^ century expositions of the calculus, including the controversy of ROBINS and JURIN, which involved a clearer statement of the theory of limits, and the work of MACLAURIN which « avoided the use of infinitely small quantities », reverting to the kinematical methods of NEWTON. The treatment of the calculus in England was at this time far in advance of the Continental treatment of the subject, achieving geometrically independence of the infinitesimals. L. C. K.

[**Cook, James.** 1728 1779.] Memorial to Captain JAMES COOK. *Isis*, II, p. 395, 1919. 1818

About the unveiling of his statue in the Mall, London, July 7, 1914. Short note. G. S.

Darboux, Gaston. Notice historique sur le général MEUSNIER, membre de l'ancienne Académie des Sciences... In : *Eloges académiques et discours*, p. 218 262 Paris, HERMANN, 1912. 1818

Notice lue à l'Académie en 1909 et consacrée à l'officier de génie et au géomètre JEAN BAPTISTE MARIE CHARLES MEUSNIER DE LAPLACE (Tours 1754-Mayence 1793). G. S.

Ebstein, Erich. Aus GEORG CHRISTOPH LICHTENBERGS Frühzeit. *Archiv f. Gesch. d. Naturw.*, VII, p. 129-140, 5 Abb. Leipzig 1916. 1818

Ephraïm, Julius. Die Vorläufer von NICOLAS LEBLANC. *Archiv f. Gesch. d. Naturw*, VIII, p. 222-224. Leipzig 1918. 1818

Discussion of the question whether BRYAN HIGGINS's Patent 1302 of 1781 contains the discovery of the LEBLANC process for the fabrication of Soda or not. RICHARD SHANNON's Patent 1223 of 1779 is also considered. G. S.

Feldhaus, Franz M. Zur Geschichte der « eisernen Jungfrau ». *Geschichtsblaetter f. Technik u. Industrie*, Bd. VI, 58 Berlin 1919. 1818

MUMMENDORFF showed in 1906 that the famous « iron virgin » of Nuremberg is a forgery. FELDHAUS gives evidence that the use of such an abominable instrument was thought of in 1730-1731. G. S.

Garrison, Fielding H. A brief history of gastric intubation. *Boston Medical and Surgical Journal*, CLXXIV, p. 267-270, 1916 1818

MONRO *secundus* (1763), JOHN HUNTER (1790), MONRO *tertius* (1797) and LARREY *senior* (1799) employed or recommended each a flexible tube for artificial feeding or for withdrawal of the contents of the stomach. Next records : PHILIP SYNG PHYSICK (1802, 1812), FRANCIS BUSH and EDWARD JUKES (1822), etc. G. S.

Johnston, G. A. (*editor*). Selections from the Scottish philosophy of common sense, VIII + 267 p. Chicago, Open Court Co., 1915. 1818

See *Isis*, III, p. 289 (JOURDAIN).

Kaye, G. R. The astronomical observatories of JAI SINGH. f°, VIII + 153 p., 26 pl. Calcutta, Superintendent Government Printing, 1918. 1818

See *Isis*, II, p. 421-423 (SARTON).

Keller, Karl. JOHANN ANDREAS SEGNER. *Beitr. z. Gesch. d. Technik u. Industrie*, V, p. 54-72. Berlin 1913. 1818

Bio- and bibliography with portrait of J. A. SEGNER (Presburg 1704-1777), Göttinger physician, mathematician and physicist, father of the hydraulic turbine. G. S.

Kunz, George F. DÉODAT DOLOMIEU. *Scientific monthly*, VIII, p. 527-536. Lancaster, Pa., 1919. 1818

Based upon ALFRED LACROIX. Notice historique sur DÉODAT DOLOMIEU (1750-1801), 88 p., portrait). Paris, GAUTHIER-VILLARS, 1918. G. S.

[**La Caille, Nicolas Louis de** (1713-1762)]. Souscription internationale pour l'érection d'un monument à sa mémoire à Rumigny (Ardennes). *Isis*, II, p. 396-397, 1919. 1818

Texte de la circulaire publiée par le comité présidé par DARBOUX, LAVISSE et BAILLAUD. G. S.

Lacroix, Alfred. DÉODAT DE DOLOMIEU [Dolomieu (Dauphiné), 1750. Châteauneuf (Charollais), 1801]. *Revue scientifique*, p. 33-49, 1919.

Müller, Franz Johann. GEORG FRIEDRICH BRANDER. *Z. d. Ver. d. höh. bayer. Vermessungsbeamten*, Bd. 14, 30 S. Würzbourg 1910 1818

Biography and bibliography of G. F. BRANDER (Ratisbon 1713-1783) the greatest German maker of scientific instruments of his time. Guided by J. H. LAMBERT, he was the founder of this modern industry in Germany. G. S.

Smith, Edgard F. Chemistry in old Philadelphia, 106 p. Philadelphia, LIPPINCOTT, 1919. 1818

Anecdotes relating to the last third of the XVIII^th^ century and the beginning of the XIX^th^. G. S.

Stein, Robert. GOETHES Weinflaschen-Ausblühung und GÖTTLINGS Probierkabinett [1788]. *Archiv f. Gesch. d. Naturw.*, VIII, p. 187-205. Leipzig 1918. 1818

Tweedie, Chas. A study of the life and writings of COLIN MACLAURIN. *Mathematical Gazette*, VIII, p. 133-151. London 1915. 1818

See *Isis*, III, p. 289-290 (JOURDAIN).

[**Watt, James** (1736-1819)]. JAMES WATT's Engine. *Isis*, II, p. 397, 1919. 1818

Short note on WATT's engine, and on his ideas on the decimal system of weights and measures. G. S.

Wickersheimer, Ernest. La Thériaque céleste dite de « Strasbourg ». *Bulletin de la Société d'histoire de la pharmacie*, 8 p. Paris, mars 1920. 1818

La thériaque céleste inventée par le médecin français JOSEPH DU CHESNE, dit QUERCÉTAN, en ou vers 1607, fut introduite par FRÉDÉRIC STROEHLIN à Strasbourg et y eut un si grand succès que les désignations thériaque céleste et thériaque de Strasbourg devinrent équivalentes. Elle figure dans les pharmacées strasbourgeoises publiées en 1725 et 1757. Une planche en couleur intitulée : « Expositio theriacae Andromachi et coelestis ut et Mithridatii in officina Stroehliniana. M.DCC.XLIV représente la composition de cette drogue. G. S.

S. XIX

A. — *Mathematics*

Archibald, R. C. Remarks on KLEIN's « famous problems of elementary geometry ». *American mathematical monthly*, XXI, p. 247-259, 1914. 1818

Interesting discussion, with bibliographical references, of recent work touching the Gaussian polygons, the irrationality of π, and constructions with ruler and compass. L. C. K.

Bussey, W. H. The tactical problem of STEINER. *American mathematical monthly*, XXI, p. 3-12, 1914. 1818

Solution of the triad problems of STEINER, with extensions. L. C. K.

Cajori, Florian. History of symbols for *n*-factorial, *Isis*, III, p. 414-418, 1921. 1818

The history of this algebraic notation leads CAJORI to examine the question : to what extent can specialized notations be adopted with profit? , his answer being : only experience can tell. It is here that the historian comes in. It would be worth while to complete CAJORI's investigation by examining the various applications of *n*-factorial and finding out in each case whether a special symbol is useful or not. For inst., would the formulas of combinatorial analysis be less or more intelligible without this symbol? G. S.

Miller, G. A. Bits of history about two common mathematical terms. *American mathematical monthly*, XXVI, p. 290-291, 1919. 1818

Discussion of the terms « indicator » and « simple group ». L. C. K.

[Poincaré, Henri, 1854-1912]. Comité international de la médaille et de la fondation HENRI POINCARÉ. *Isis*, II, p. 398-399. 1919. 1818

Texte de la circulaire lancée en juin 1914 par ce comité. G. S.

B. — *Physical sciences and technology*.

[Ampère, André-Marie, 1775-1836]. Un monument à sa mémoire. *Isis*, II, p. 397. 1919. 1818

Short note (7 l.) about the monument which was to be unveiled in Poleymieux les-Mont-d'Or on Aug. 2, 1914. G. S.

Bombe, H. Die Entwicklung der Strassenbahnwagen. *Beitr. z. Gesch. d. Technik u. Industrie*, V, p. 214-229, 36 Fig. Berlin 1913. 1818

Clemen, O. Vom chemiker THEODOR VON GROTTHUSS. *Archiv für Gesch. d. Naturw.*, VII, p. 377-389. Leipzig 1916. 1818

CHRISTIAN JOHANN DIEDRICH (= THEODOR) VON GROTTHUSS (Leipzig 1785-1822), a nobleman of Courland. Five letters to him are quoted. G. S.

Gebhardt, Otto. Ein Beitrag zur Untersuchung der exakten Grundlagen der Elektrolyse mit besonderer Berücksichtigung der Ueberführungszahlen. *Archiv f. Gesch. d. Naturw.*, VII, p. 207-219, 404-419. Leipzig 1916. 1818

Klinckowstroem, Carl von. Julius Konrad von Yelin und seine technologische Reisen nach England im Jahre 1825. *Geschichts blätter für Technik u. Industrie*, VI, p. 41-58. Berlin 1919. 1919

Larmor, Sir Joseph. On Carnot's theory of heath. *Scientia*, XXIV, p. 183-194. Bologna 1918. 1918

Lespieau, R. La molécule chimique, 286 p. Paris, Alcan, 1920. 1918

See *Isis*, III, p. 426-428 (Guinet).

[Lilienthal, Karl Wilhelm Otto, 1848-1896]. *Isis*, II, p. 398. 1919. 1919

12 l. about the memorial unveiled in Berlin on June 17, 1914. G. S.

Macfarlane, Alexander [1851-1913]. Lectures on ten British physicists of the XIXth century. New York, Wiley, 1919. 1918

See *Isis*, III, p. 291 (Sarton).

Martell, Paul. Zur Geschichte des Eisenbahngleises. *Archiv f. Gesch. d. Naturw.*, VIII, p. 41-48. Leipzig 1917. 1918

Mieli, Aldo. Il periodo atomico moderno. Parte terza : La risoluzione del problema. *Scientia*, XXIII, p. 23-35. Bologna 1918. 1918

Mueller, Franz Johann. Joseph von Ranson [München 1774 — *ibid* 1846] und die bayerische Landesvermessung. *Zeitschrift des Vereins der höheren bayerischen Vermessungsbeamten*, XX, p. 67-79. München 1916. 1918

Mueller, Franz Johann. Ein unveröffentlichter Brief Soldners [1819] an den Kanonikus Stark in Augsburg. *Z. d. Ver. d. höh. bayer. Vermessungsbeamten*, XXIII, p. 118-120. München 1919. 1918

Mueller, Franz Johann Johann Georg von Soldner, der Geodät (Diss., Kgl. Techn Hochsch., München). Mit 3 Bildn. u. 4 Fig. im Texte. Erweiterter S A aus dem XVII. Bd. (1913) der *Zeitschrift d. Vereins der höheren bayer. Vermessungsbeamten*, 164 S. München 1914. 1918

Important biographical notes chiefly based on unpublished documents and correspondence and completing Bauernfeind's biography of Soldner [1776-1833] in vol. XXXIV of the Allgemein. Deutsche Biogr. Divided as follows: S. im Verhältnis zu seinen Zeitgenossen; Würdigung von S.'s Leistungen; Verzeichnis ü. S.'s Schriften; Anlagen (series of documents, chiefly letters, reproduced *in extenso*. The most interesting of these documents is an autobiographical note relating to S.'s youth).

G. S.

Niemann, W. J. F. Kammerer, der Erfinder der Phosphorzündhölzer. *Archiv f. Gesch. d. Naturw.*, VIII, p. 206-221, 2 Abb. Leipzig 1918. 1918

Jakob Friedrich Kammerer (Ehningen, Oberamt Böblingen, 1796 — Ludwigsburg 1857); first fabrication of phosphoric matches by him, 1832. On the history of chemical matches see also *Isis*, III, p. 485. G. S.

Roentgen, W. C. Grundlegende Abhandlungen über die X-Strahlen. Zum siebzigsten Geburtstag des Verfassers herausgegeben von

der Physikalisch-Medizinischen Gesellschaft in Würzburg, 43 S., 1 Porträt Würzburg, Curt Kabitzsch, 1915. 1918

Contains a reimpression of the three fundamental papers of Röntgen on X-Rays, to wit : « Ueber eine neue Art von Strahlen », two papers published in the *Sitzungsberichte der Physik-Med. Gesell.* in Würzburg, Jahr. 1895, the first dated Dez. 1895, the second 9 März 1896 — Weitere Beobacht. ü. die Eigenschaften der X-Strahlen. *Sitzungsber. d. K. Pr. Akad. d. Wissensch.*, in Berlin vom 13 Mai 1897 — Good portrait. G. S.

Schiff, Julius. Zur Geschichte der konstanten galvanischen Elemente. *Archiv f. Gesch. d. Naturw.*, VII, p. 288-298. Leipzig 1916. 1918

C. — *Natural sciences*

Calvert, Philip P. A bust of the late Professor Edward Drinker Cope [1840-1897]. *Science*, LI, p. 264-265. New York 1920. 1918

Bust presented by a body of subscribers to the Zoological Laboratory of the University of Pennsylvania in Philadelphia. It is the work of Eugen Castello. The head is an exact duplicate of the living head. G. S.

Fabre, Jean Henri [1823-1915]. Le monument de Sérignan. *Isis*, II, p. 397, 1919. 1918

7 lines about this contemplated memorial. G. S.

May, Walther. Franz Wilhelm Junghuhn, ein Vorläufer Darwins. *Archiv f. Gesch. d. Naturw.*, VIII, p. 182-186. Leipzig 1918. 1918

F. W. Junghuhn (Mansfeld, Prussia 1812 — Lemberg 1864), published in 1854 a book in Dutch (Licht- en schaduwbeelden uit de binnenlanden van Java, Amsterdam 1854) in which the idea of evolution is clearly explained. G. S.

Pelseneer, Paul. Les premiers temps de l'idée évolutionniste. Lamarck, Geoffroy Saint-Hilaire et Cuvier *Annales de la Société royale zoologique et malacologique de Belgique*. L, (1914-1919), p. 53-89. Bruxelles 1920. 1918

Portraits très vivants des trois protagonistes de ce grand drame scientifique. G. S.

D. — *Medical sciences*

Bilharz, Theodor (1825-1862). *Archiv f. Gesch. d. Naturw.*, VIII, p. 232-236. Leipzig, 1918. 1918

Anonymous biography with portrait of the discoverer of *Distomum haematobium* Bilh. ; named *Bilharzia* by H. M. von Helmsbach. Born in Sigmaringen, died in Cairo. G. S.

[**Mosso, Angelo** 1846-1910.] *Isis*, II, p. 398, 1919. 1918

Memorial to be unveiled in Torino, on Nov. 14, 1914. 7 lines. G. S.

E. — *Alia*

Browne, E. G. Materials for the study of the Bábí Religion, XXIV + 380 p., numerous plates and fac-similes. Cambridge, University Press, 1918. 1918

A very valuable and interesting account of the rise and development of a

religion. It is chiefly valuable as throwing light on the origin of myth and because every step in the embryology of a new and ethical religion can be examined in detail. An important contribution to sociological thought. C. S.

Darboux, Gaston. Eloges académiques et discours. Volume publié par le comité du jubilé scientifique de M. GASTON DARBOUX, 525 p., un portrait. Paris. HERMANN, 1912. 1818

A l'exception d'une notice consacrée au Général MEUSNIER (voir *Isis*, III, p. 463), ce livre est entièrement consacré au XIX^e^ siècle. Il contient de longues biographies de JOSEPH BERTRAND, FRANÇOIS PERRIER. CHARLES HERMITE, ANTOINE D'ABBADIE et une série de documents relatifs à l'histoire de l'Association internationale des Académies. La fin du livre est consacrée au jubilé de DARBOUX. G. S.

Gunther, R. T. The DAUBENY Laboratory Register. Printed for the subscribers. Oxford, University Press, 1916. 1818

This little work contains what is practically a history of the study of science in Oxford in the first half of the XIX^th^ century. C. S.

Keller, Adolf. Eine Philosophie des Lebens (HENRI BERGSON), 46 p. Jena, DIEDERICHS, 1914. 1818

Explanation and criticism of BERGON's philosophy first published in the Swiss magazine « Wissen und Leben ». G. S.

Marvin, Francis Sydney. The Century of Hope. A sketch of Western progress from 1815 tho the great war. VII + 352 p. Oxford, CLARENDON Press, 1919. 1818

See *Isis*, II, p. 425-427 (SARTON).

[*Nature*]. The Jubilee of Nature (1869-1919). *Isis*, III, p. 60-62, 1920 1818

To celebrate the golden jubilee of the great scientific weekly *Nature*, founded by Sir NORMAN LOCKYER. The first number appeared on Nov. 4, 1869. A memorial number published on Nov. 6, 1919, contains a series of reviews of the work done in the different fields of science during the last half-century. G. S.

Ostwald, Wilhelm. AUGUSTE COMTE, der Mann und sein Werk. Mit COMTE's Bildnis, XII + 288 p. Leipzig, Unesma, 1914. 1818

See *Isis*, II, p. 423-424 (E. BLOCH).

Sarton, George. HERBERT SPENCER, 1820-1920. *Scribner's Magazine*, LXVII, p. 695-701. New York 1920. 1818

Short biography and criticism of SPENCER apropos of the centenary of his birth. This is only a pretext however and the real burden of this essay is the solution of the two following questions : « Is synthetic knowledge desirable and should it be encouraged? And if so, it is possible for any man, however intelligent, to acquire it? » The author answers both questions affirmatively. G. S.

Sarton, George. HERBERT SPENCER, 1820-1903 *Isis*, III, p. 375-390, 1921. 1818

Reprint of the essay published in *Scribner's Magazine* for June 1920,

together with bibliographical and iconographical notes and a portrait. The portrait is a reproduction of GEO. E. PERRINE'S engraving (*Eclectic Magazine*, XV, New York 1872) based on a photograph by JOHN WATKINS made in or about 1865 (Ae. 45). G. S.

Sastri, Sivanath. History of the Brahmo Samaj [1828-]. I and II. Calcutta, CHATTERJEE, 1911-1912. 1818

See *Isis*, III, p. 428-429 (SARTON).

PART II

Historical Classification

The materials which could not be included in the Centurial Classification are classified, if possible, under one of the following headings :

1. Antiquity.
2. Antiquity, classical.
3. Asia (Central, Eastern, Western).
4. Babylonia a. Assyria.
5. Bible Old Test.).
6. Byzantium.
7. China.
8. Egypt.
9. Greece.
10. India.
11. Iran.
12. Islam.
13. Israel.
14. Japan.
15. Middle Ages
16. Rome.

Items which pertain at the same time to more than one of these headings are preferably put in the Systematic Classification (Part III).

1. — ANTIQUITY

Airy, W. On the ancient trade weights of the East, 36 p. Privately printed, Croom's Hill, Greenwich London, S. E. 10, 1918 1818

Simplified account of the ancient weights of the Near East to show how they were related to one another and to the more modern systems of Europe and Asia. AIRY examines successively the Egyptian. Phoenician, Mesopotamian, Greek and Roman weights, then also various modern native weights. Six synoptic tables but no bibliography. G. S.

Petrie, W. M. Flinders. Tools and Weapons illustrated by the Egyptian collection in University College, London, and 2.000 outlines from other sources, VII + 73 p., 83 pl. London, University College, 1917. 1818

See *Isis*, III, p. 314-315 (SARTON).

Richardson, Leon J. Digital Reckoning Among the Ancients. *American mathematical monthly*, XXIII, p. 7-13, 1916. 1818

Historical discussion of the use of the fingers in representing numbers and in counting and computing, with bibliography. L. C. K.

Sidersky, D. Le commencement de l'année chez les peuples de l'antiquité. *Journal Asiatique*, V, p. 380-382. Paris 1915. 1818

SIDERSKY recherche les causes qui ont fait fixer ce commencement à telle ou telle date et montre l'importance qu'avaient à ce propos les phénomènes astronomiques et les travaux agricoles. G. S.

2. — ANTIQUITY, CLASSICAL

Diels, Hermann. Antike Technik. Sieben Vorträge. 2te erweit. Aufl., VIII + 243 p., 19 Taf. Leipzig, TEUBNER, 1920. 1818

See *Isis*, III, p. 433-434 (SARTON).

Hoppe, Edmund. Magnetismus und Elektrizität im klassischen Altertum. *Archiv f. Gesch. d. Naturw.*, VIII, p. 92-105. Leipzig 1917. 1818

James, M. R. The Wanderings and Homes of Manuscripts. (Helps for students of history. No 17), 96 p. London, Society for promoting Christian knowledge, 1919. 1818

Deals exclusively with Greek and Latin MSS. — The Provost of Eton has made no attempt to exhaust the subject but he has given a very readable and suggestive introduction, well calculated to awake the vocation of a future scholar. G. S.

Lattes, Elia. L'enigma etrusco. *Scientia*, XXV, p. 288-294. Bologna 1919.

The author maintains that the Etruscan enigma is well on the road to its solution and that the nearer to it one will reach, the more obvious will the analogies between the Latin and Etruscan languages become. G. S.

Petrie, W. M. Flinders. The Origin of the Alphabet. *Scientia*, XXIV, p. 438-444. Bologna 1918. 1818

Schoy, Carl. Theorie der sog. Zwillingssonnenuhr aus Pergamon. *Naturwissenschaftliche Wochenschrift*, Bd. 14, p. 401-406, 3 Abb. Jena 1915. 1818

Mathem. theory of the singular double sundial discovered at Pergamum in 1907, and described by A. REHM in 1911. G. S.

Stéphanidès, Michel. Contributions à l'Histoire des Sciences et particulièrement de la Chimie (*en grec*). Athènes 1914. 1818

See *Isis*, III, p. 430-433 (SARTON).

3. — ASIA, WESTERN

Basmadjan, K. J. Les livres de médecine chez les Arméniens. *Journal Asiatique*, V, p. 383-386. Paris 1915. 1818

7. — CHINA

Laufer, Bertold. Sino-Iranica. Chinese contributions to the history of civilization in ancient Iran, with special reference to the history of cultivatedplants and products. Chicago 1919. 1818

See *Isis*, III, p. 299-302 (SARTON).

Loria, Gino. Che cosa debbono le matematiche ai Cinesi? *Bollettino della Mathesis*, anno XII, p 63-76, 1920. 1818

Summary based chiefly on Y. MIKAMI, 1912. G. S.

Pelliot, Paul. Le Chou King en caractères anciens et le Chang Chou Che Wen. *Mémoires concernant l'Asie orientale*, II, p. 123-177, pl. XX-XXVI. Paris 1916. 1818

Petrucci, Raphael. L'épigraphie des bronzes rituels de la Chine ancienne. *Journal Asiatique*, VII, p. 1-76, 4 pl. Paris 1916. 1818

8. — EGYPT

Moret, Alexandre. L'écriture hiéroglyphique en Egypte. *Scientia*, XXV, p. 94-125. Bologna 1919. 1818

9. — GREECE

Archibald, R. C. Centers of similitude of circles and certain theorems attributed to MONGE. Were they known to the Greeks? *American mathematical monthly*, XXII, p. 6-12, 1915. 1818

Assertion, based upon restorations of certain theorems of PAPPUS particularly by SIMSON and SCORZA, that PAPPUS and the Greeks were familiar with the theory of MONGE concerning the six centers of similitude of three coplanar circles. The use of the center of similitude by the Greeks is definitely established, and also a particular case of MONGE's Theorem
L. C. K.

Crawfurd, R. On forerunner of HARVEY in antiquity, 40 p. London, ADLARD, 1919. 1818

An admirably clear and succinct account of the views of the ancients on the nature and structure of the vascular system. C. S.

Loria, Gino. L'infinito e l'infinitesimo secondo i matematici dell' antichità. *Scientia*, XVIII, p. 357-368. Bologna 1915. 1818

Mieli, Aldo. La scienza greca e le caratteristiche del suo sviluppo. *Scientia*, XVIII, p. 225-233. Bologna 1915. 1818

Singer, Charles. Greek science and modern science. A comparison and a contrast, 22 p. London, University of London Press, 1920. 1818

Inaugural lecture delivered at University College, London on 12 May, 1920.

Stéphanidès, Michel. Petites contributions à l'histoire des sciences. *Revue des études grecques*, XXXI, p. 197-206. Paris 1918. 1818

Série de courtes notes de philologie relatives à des mots techniques. La critique expérimentale. Un essai du cinabre chez les anciens. Λακήματα, Χάλασις = ἄνεσις. Ῥαρία (κούφη). ATHÉNÉE et HOMÈRE. Le cuivre mossynique. Βροντήσιον. Κλαυδιανόν. Le metal σταγών. Cuivre persan ou indien. Science et inertie. G. S.

10. — INDIA

Avalon, Arthur [*pseudonym*]. Works on Tantra : Tantra of the Great Liberation (Mahânirvâṇa Tantra), transl. with introduction and comm., CXLVI + 359 p. London, LUZAC. 1913. — Hymns to the Goddess, by ARTHUR and ELLEN AVALON, XII + 179 p. — Principles of Tantra... by A. AVALON, LXXXI + 393 p. *Ibidem*, 1913. 1818

See *Isis*, III, p. 77-81 (MASSON-OURSEL).

Avalon, Arthur (*editor*). Tantrik Texts, I-III. Calcutta, Sanskrit Press; London, Luzac, 1913-1914. 1918

See *Isis*, III, p. 77-81 (Masson-Oursel).

Baedeker, Karl (*editor*). Indien. Ceylon. Vorderindien. Birma. Die malayische Halbinsel. Siam. Java. Handbuch für Reisende, LXXIV + 358 p., 22 Karten, 33 Plänen, 8 Grundrissen. Leipzig, Baedeker, 1914. 1918

See *Isis*, II, p. 401-402 (Sarton).

Barnett, Lionel D. Antiquities of India. An account of the history and culture of ancient Hindustan, XVI + 306 p. illustr. London, Ph. L. Warner, 1913. 1918

See *Isis*, II, p. 408-410 (Sarton).

Barth, Auguste. Quarante ans d'indianisme, I, II, III. Paris, Leroux, 1914. 1918

See *Isis*, III, p. 65-66 (Masson-Oursel).

Bhandarkar, Sir **R. G.** Vaiṣṇavism, S'aivism and minor religious systems, 169 p. Strassburg, Trübner, 1913. 1918

See *Isis*, III, p. 76-77 (Masson-Oursel).

Bhishagratna, Kaviraj Kunja Lal. An English translation of the Sushruta Samhita based on the original Sanskrit text 3 vol. in-8°: I, XLVII + 571 p., 4 pl.; II, 762 p., 2 pl.; III, XIV + 416 + 81 p. Published by the author, 10 Kashi Ghose's Lane, Calcutta, 1907-1916. 1918

In spite of some obvious blemishes this book is of value as an honest attempt on the part of an Indian scholar to make a classic of Indian medicin e accessible to Westerners. It is somewhat marred by the usual and natural desire on the part of Indians to exalt their national literature but the effort as a whole is not an unworthy one and should be encouraged. As to the philological value of the work it is for Sanskrit scholars to decide but the historian of medicine will welcome the access to the text which these volumes give. C. S.

Carus, Paul [1852-1919]. The Gospel of Buddha according to old records, XVI + 275 p., 1st ed. 1894, 2d ed. 1905. Chicago, Open Court. 1918

See *Isis*, III, p. 74-75 (Masson-Oursel).

Carus, Paul. Stories of Buddhism, a trilogy comprising: Karma, a story of Buddhist ethics, 46 p., 1903; Amitâbha, a story of Buddhist theology, 121 p., 1906; Nirvana, a story of Buddhist psychology, 93 p. 1913. Chicago, Open Court. 1918

See *Isis*, III, p. 75-76 (Masson-Oursel).

Coomaraswamy, Ananda K. Visvakarmâ. Examples of Indian architecture, sculpture, painting, handicraft First series: One hundred examples of Indian sculpture, 103 pl., 31 p. London, Luzac. 1914. 1918

See *Isis*, II p. 403-404 (Sarton).

Coomaraswamy, Ananda K. The arts and crafts of India and Ceylon, XXII + 256 p., 225 ill. London, FOULIS, 1913. 1818

See *Isis*, II, p. 404-407 (SARTON).

Deussen, Paul. The System of the Vedânta, according to BÂDARÂYANA's Brahma-Sûtras and ÇANKARA's commentary thereon set forth as a compendium of the dogmatics of Brahmanism from the standpoint of ÇANKARA, translated by CHARLES JOHNSTON, XV + 513 p. Chicago, Open Court, 1912. 1818

See *Isis*, II, p. 407-408 (SARTON).

Hackin J. Les scènes figurées de la vie du Bouddha d'après des peintures thibétaines. *Mémoires concernant l'Asieorientale*, II, p. 1-116, 18 pl. Paris 1916. 1818

Jouveau-Dubreuil, G. Archéologie du Sud de l'Inde. I. Architecture; II. Iconographie, 2 vol., 192 + 152 p., 71 + 40 fig., 64 + 44pl. Paris, GEUTHNER, 1914. 1818

See *Isis*, III, p. 66-67 (MASSON-OURSEL).

Karpinski, L. C. Hindu Science. *American mathematical monthly*, XXVI, p. 298-300, 1919. 1818

Brief critical review of SARKAR's « Hindu Achievements in Exact Science », and KAYE's « The Astronomical Observatories of JAI SINH ». Rejection of the extravagant claims of Hindu originality by SARKAR, and also of the total denial of Hindu originality in mathematics by KAYE. L. C. K.

Kaye, G. R. Indian Mathematics. *Isis*, II, p. 326-356, 1919. 1818

This essay written in 1913, printed and proof-read in 1914, has been published separately in 1915 under the same title (Calcutta, THACKER, SPINK and Co.) The Calcutta edition contains the Brussels text, plus a few extracts from the sources, a chronology and index. Essential bibliography, p. 355-356. G. S.

Macdonell, A. A. and **Keith A. B.** Vedic index of names and subjects. 2 vol. XVI + 554 p., 592 p. London, JOHN MURRAY, 1912. 1818

See *Isis* III, p. 84-87 (MASSON-OURSEL).

Masson-Oursel, P. Bibliographie sommaire de l'Indianisme. *Isis*, III, p. 171-218, 1920. 1818

A general bibliographical introduction to Indian studies, divided as follows : I. Bibliographie générale. — II. Linguistique. — III. Littérature. — IV. Histoire. — V. Sociologie. — VI. Sciences. — VII. Art. — VIII. Les influences étrangères sur l'Inde. L'Inde hors de l'Inde. G. S.

Mukhopadhyaya, Girindranath. The surgical instruments of the Hindus with a comparative study of the surgical instruments of the Greek, Roman, Arab and modern European surgeons. 2 vol. : I, XXXII + 444 p. ; II, 11 p. + 82 pl. Calcutta, University, 1913-1914. 1818

A scientific account of Hindu surgery is a desideratum which these volumes hardly supply. They are however an improvement on some previous

works. The main thesis of the author is that Hindu surgery though resembling Greek surgery and its derivatives was either anterior to it or developed independently. To establish this thesis it would be first necessary to fix the dates of the ancient Indian surgical works. As he produces no evidence on this all important point his argument falls to the ground. He has nevertheless put together some useful data which when more critically treated will be of great interest. C. S.

Murray, John (*editor*). A handbook for travellers in India, Burma and Ceylon. Ninth edition, CLXVIII + 664 p., 79 maps and plans. London, MURRAY, 1913. 1913

See *Isis*, II, p. 402-403 (SARTON).

Rapson, E. J. Ancient India, from the earliest times to the first century A. D. VIII + 199, 6 ill., 2 maps. Cambridge, University Press, 1914. 1913

See *Isis*, III, p. 83-84 (MASSON-OURSEL).

Ray, Sir Praphulla Chandra. A history of Hindu chemistry from the earliest times to the middle of the XVI[th] century A. D. with Sanskrit texts, variants, translations and illustrations : I, 2[d] enl. ed., CXXXII + 312 + 70 p., 1903; II, 17 + XCVI + 290 + 152 + 21 p. 1909. Calcutta, Bengal chemical and pharmaceutical works. 1913

See *Isis*, III, 68-73 (MASSON-OURSEL).

Ray, Sir Praphulla Chandra. Chemical knowledge of the Hindus of Old. *Isis*, II, p. 322-325, 1919. 1913

Short summary of this knowledge chiefly based on the author's History (1903-1909). G. S.

Sarkar, Benoy Kumar. The positive background of Hindu sociology. Book I. Non-Political. With appendices by B. SEAL, XXIV + 365 p. Allahabad, Panini Office, 1914. 1913

See *Isis*, III, p. 63-64 (P. MASSON-OURSEL).

Sastri, Sivanath. History of the Brahmo Samaj [1828-]. I and II. Calcutta, CHATTERJEE, 1911-1912. 1913

See *Isis*, III, p. 428-429 (SARTON).

Schroeder, Leopold von. Reden und Aufsaetze, vornehmlich über Indiens Literatur und Kultur, XIII + 430 p. Leipzig, HOESSEL, 1913. 1913

See *Isis*, III, p. 81-82 (MASSON-OURSEL).

Seal, Brajendranath. The positive sciences of the ancient Hindus, VIII + 295 p. London, LONGMANS, GREEN and Co., 1915. 1913

This book is better balanced than the great majority of works on Indian science and above all does not claim for its material an unprovable antiquity and independence. What it gains in critical power however, it looses in lucidity and much of what is written in it conveys no meaning whatever to the reviewer. The author has the usual Indian weakness for classification and numerical statement for their own sake rather than to help the reader or

elucidate the subject. There must be coherent ideas at the back of Indian science but the reviewer confesses that, though he has read a number of books on the subject, he has not succeeded in arriving at them. This negative result drawn from a work by the GEORGE V. Professor of Philosophy at the Calcutta University is a distinct disappointment. C. S.

Sirkar, Kishori Lal. An introduction to the Hindu system of physics, being an exposition of *Kanad-Sûtras* relating to the subject. VII + 108 p. Calcutta, SEAL, 1911. 1818

See *Isis*, III, p. 64-65 (MASSON-OURSEL).

Suali, Luigi. Essai sur la théorie de la connaissance dans la philosophie indienne. *Isis*, III, p. 219 254, 1920. 1818

A survey of Indian epistemology, largely based upon the author's « Introduzione allo studio della filosofia indiana ». Pavia 1913. G. S.

Vallauri, Mario. La medicina indiana. *Scientia*, XVIII, p. 308-324. Bologna 1915. 1818

11. — IRAN

Browne, E. G. Materials for the study of the Bábí religion. XXIV + 380 p., numerous pl. and fac-similes. Cambridge, University Press, 1918. 1818

See under S. XIX, E, p. 467-468. (C. S.)

Jackson, A. V. Williams and **Abraham Yohannan.** A Catalogue of the collection of Persian Manuscripts... presented to the Metropolitan Museum by ALEXANDER SMITH COCHRAN. (Indo Iranian Series, I), XXV + 187 p. New York, Columbia University Press, 1914. 1818

MSS. of FIRDAUSÎ, NIZÂMÎ, JALAL AD-DIN RÛMÎ, SA'DÎ, the Indo-Persian poet AMIR KHUSRAU of DELHÎ, HÂFIZ, JÂMÎ. There are also two Turkish MSS. of MIR 'ALÎ SHÎR NAWÂ'Î and a MS. of the QUR'ÂN. G. S.

12. — ISLAM

Ahrens, W. Studien über die magischen Quadrate der Araber. *Der Islam*, VII, p. 186-250. Strassburg 1917. 1818

1. DSCHABIR B. HAIJÂN. — 2. Das magische Quadrat der 9 Zellen. Seine verschiedenen Formen. Sein frühestes Auftreten. — 3. Magische Quadrate höherer Stufen. Bildung der ungeradzelligen Quad. nach der « Methode der Inder ». — 4. Das System der 7 Planetentafeln. — 5. GHAZÂLÎ. — 6. Die lauteren Brüder. — 7. 12-14 Jahrh. — 8. Die Neuzeit. — 9. Nichtmagische Zahlenquadrate. — Namenverzeichnis. — Addenda (E. WIEDEMANN), *Ibid.*, VIII, p. 94-97. G. S.

Airy, W. On the Arabic glass weights, 6 p. Privately printed. Croom's Hill, Greenwich. London S. E. 10, 1920. 1818

Based upon a study of the glass money- and « fels » weights kept in the English and Scotch museums. It would appear that after the conquest of Egypt, the Arabs used their carob scale in conjunction with the Egyptian shekel weights and made the two systems fit together at certain values as well as they could. The small weight of the carob (3 grains) made this relatively easy. G. S.

Carra de Vaux, Bernard. Notes d'histoire des sciences. *Journal Asiatique*, X, p. 449-461. Paris 1917. 1918

See *Isis*, III, p. 434-435 (SARTON).

Horten, Max. Einführung in die höhere Geisteskultur des Islams. Gemeinverständlich dargestellt. XV + 112 p. Bonn, COHEN, 1914. 1918

This is a systematic, not an historical account of Mohammedan philosophy, and it is chiefly devoted to metaphysical questions. As the sequence of philosophical problems is different in the different Moham. systems, HORTEN has preferred to adopt a systematic presentation of his own, to wit: *A*. Logik. — *B*. Die eigentliche Philosophie: (1) Metaphysik. Das System der Wissenschaften; (2) Die einzelgebiete der Philosophie: *a*) Gott, *b*) die Geisteswelt; (*c*) die Seelen; (*d*) die Körperwelt; (*e*) Hyle und Form. — Anhang: Ethik. — Chapters *d* and *e* are of special interest to us, but they are rather meagre, HORTEN being far more interested in metaphysics and theology than in science. The higher intellectual culture of Islam is a development of Hellenism, with the incorporation of Persian and Hindoo elements. HORTEN has provided us with a useful guide for the understanding of this syncretism. G. S.

Littmann, E. Ueber die Ehrennamen und Neubenennungen der islamischen Monate. *Der Islam*, Bd. 8, p. 228-236. Strassburg, 1918. 1918

Meyerhof, Max. Beiträge zum Volksheilglauben der heutigen Aegypter. *Der Islam*, VII, p. 307-344. Strassburg 1917. 1918

Rescher, O. Studien über den Inhalt der 1001 Nacht. *Der Islam*, Bd. 9, p. 1-94. Strassburg 1919. 1918

Life and thought of the Islamic East as revealed in the Thousand and One Nights. The most interesting chapters for us are those on superstitions and magic. No chapter on science and no index. Criticism of editions and translations; MARDRUS' transl. forgotten. G. S.

Ritter, Hellmut. Arabische Flussfahrzeuge auf Euphrat und Tigris. Mit 20 Taf. u. 5 Zeichn. (Mesopotamische Studien, I). *Der Islam*, IX, p. 121-143. Strassburg 1919. 1918

Ruska, Julius Zur Geschichte der arabischen Algebra und Rechenkunst. *Der Islam*, IX, p. 116-117. Strassburg 1919. 1918

Summary of RUSKA's memoir: Zur ältesten arabischen Algebra und Rechenkunste. Heidelberg 1917. G. S.

Ruska, Julius Griechische Planetendarstellungen in arabischen Steinbüchern. *Sitzungsberichte der Heidelberger Ak. d. Wissensch., Philos.-histor. Klasse*, 50 p. Heidelberg C. WINTER, 1919. 1918

FRITZ SAXL had stated (1912) that the Islamitic representations of planets of the XII^th^ century and later times were directly based on Babylonian traditions, the chief transmitters being the Haranite Sabeans. Yet this theory is quite unsufficient to bridge the huge cleft between ancient Babylon and the XII^th^ century. RUSKA maintains that these planetary representations like astrology itself, are rooted in the Orientalized Hellenistic world. It was difficult to prove it however on the basis of the astrological literature, but RUSKA has now established this filiation on the basis of Arabic lapidaries of

the Bibliothèque Nationale, dealing chiefly with the engraving of planetary representations on their symbolic stones. The memoir is subdivided as follows: Griechisch-römische Zaubergemmen; Die Handschriften der Biblioth. Nat.; Textproben mit Uebersetzung und Erläuterungen. The MSS considered are those numbered 2772, 2°, and 2775, 2°, 3°, 4° in SLANE, Catal. des MSS. Arabes. G. S.

Ruska, Julius. Zur ältesten arabischen Algebra und Rechenkunst. *Sitzungsberichte der Heidelberger Akad. d. Wissensch., Philos.-hist. klasse*, J. 1917, 125 p. Heidelberg, WINTER. 1918

Fundamental contribution to our knowledge of early Arabic mathematics and chiefly of the algebra of AL KHOWARIZMI. Contains the following essays: (1) Der Titel der Algebra des MUḤAMMAD B. MŪSĀ; (2) Das Liber augmenti et diminutionis und das Kitāb algam' waltafrīḳ; (3) Die Regula Sermonis; (4) Inhaltsübersicht der Algebra M. B. MŪSĀS u. Beurteilung ihrer Quellen von COSSALI bis CANTOR; (5) Zur geschichte der arabischen Zahlbezeichnungen; (6) Ueber die Erbteilungsaufgaben in der Algebra des M B. MŪSĀ u. die ursprüngliche Anwendung der Termini māl u. schai'; (7) Die Terminologie der quadratischen Gleichungen; (8) Zum Aufbau des Zahlensystems; (9) Die Namen der arabischen Ziffern; (10) Das Kapitel von den Geschäften; (11) Aus dem Kapitel über die Messung; (12) M. B. MŪSĀ's Algebra als Teil seiner wissenschaftlichen Gesamtleistung. — RUSKA's main conclusions have the more weight that they are more cautious. Indian influences on Arabic mathematics seem to him to have been far greater than is generally admitted; Greek influences on the contrary, smaller, although he is less positive on this second point. We must remember that the Greek sources became generally accessible by translations only in the IX^th and X^th centuries. This conclusion is entirely at variance with KAYE's conclusion, but the latter has made no first hand study of the Arabic texts. Hence we must give more weight to RUSKA's judgment. — RUSKA's investigation is the more important that ROSEN's translation of AL KHOWARIZMI's Algebra (1831) is not always correct. G. S.

Schoy, Carl. Die Mekka- oder Qiblakarte. Gegenazimutale mittabstandstreue Projektion mit Mekka als Kartenmitte. *Kartographische und schulgeogr. Zeits.*, VI, p. 184-185, mit 2 Abb. u. einer Karte. Wien 1917. 1918

Schoy, Carl. Mittagslinie und Qibla. Notiz zur Geschichte der mathematischen Geographie. S. A. aus der *Z. der Gesellschaft für Erdkunde*, 19 p. Berlin 1915. 1919

The second problem, to determine the direction of the Kaaba, is a purely Mohammedan one, but the first is of universal interest. SCHOY gives its whole ancient history paying special attention to Arabic work. G. S.

Schoy, Carl. Erdmessungen bei den Arabern. S. A. aus der *Z. der Gesellschaft für Erdkunde*, 15 p. Berlin 1917. 1918

I. Die Bestimmungen des Erdumfangs nach AL-BIRŪNĪ (973-1048). — II. Die eigentlichen arabischen Gradmessungen. — III. Diskussion der verschiedenen arab. Berichte. — IV. Von den arabischen Längenmassen (nach MAḤMŪD-Bey, N. KHANIKOFF und C. A. NALLINO dürfte sich die für uns in Frage kommende arab. Meile nicht weit von dem Betrage von 2000 m. entfernen. Dann wäre die arab. Gradmessung eine ausserordentlich genaue zu nennen). — V. Schlussbemerkung. G. S.

Schoy, Carl. Geschichtlich astronomische Studien über die Dämmerung. *Naturwissenschaftliche Wochenschrift*, XIV, p. 209-214, 1 Abb., Jena 1915. 1818

Deals chiefly with Arabic astronomy and physics, as neither the Greeks, nor the Romans, nor the Hindoos made a scientific study of the morning and evening twilights. For the Moslems this study was of great religious importance. The results obtained by IBN AL HAITAM, ABUL HASSAN (the XIIIth century astronomer of Morocco, whose works were edited by SÉDILLOT, father and son) and IBN JÛNIS, are explained and discussed. G. S.

Schwarz, P. Die Zuckerpressen von Ahwâz. *Der Islam*, VI, p. 269-279, Strassburg 1916. 1813

Wiedemann, Eilhard und **Hauser, F.** Über Trinkgefässe und Tafelaufsätze nach AL-ǦAZARÎ und den BENÛ MÛSÂ. *Der Islam*, VIII, p. 55-93, 268-291, 47 Abb. Strassburg 1918. 1818

Important contribution to the study of mechanical devices in Islam. One of the oldest technical writings of this kind is the Kitâb fî'l-hijal of the BENÛ MÛSA (2^{d} half of IXth c.) largely based on HERO and PHILO. Another writing of the same authors is of Byzantine origin. The most important Arabic technical work however is the Kitâb fi ma'rifat al-hijal al-handasîja by AL-ǦAZARÎ, a « work on the knowledge of geometrical (mechanical) contrivances », composed in 1205-1206 This work is on the whole very clearly written and is partly based upon personal experiments, but the ultimate source is again Hellenistic. The present essay is based chiefly on the second part of AL ǦAZARÎ's work, and on the writings of the BENÛ MÛSÂ. G. S.

Wiedemann, Eilhard. Technisches bei den Arabern. *Geschichtsblätter für Technik u. Industrie*, VI, p. 24-30. Berlin 1919. 1818

1. Bau der Hafenmauern in 'Akka. 2. Ueber ein bewegliches Zimmer in Malaga (S. XII). 3. Unterricht in Bauen zur Zeit von HÂRÛN AL RASCHID (S. VIII). 4. Transport von grossen Steinen (S. X). 5 Wasserräder zu Küchenzwecken (S. XVII). 6. Klingelzug an Mühlen um automatisch auf deren Stehenbleiben aufmerksam gemacht zu werden (S. XVII). 7. Herstellung feiner Drähten (BIRÛNÎ, S. X-XI). 8. Verbindung von Steinen. 9. Hebung eines gesunkenen Schiffes (S. XI-XII). G. S.

Wiedemann, Eilhard und **Würschmidt, J.** Über eine arabische kegelförmige Sonnenuhr. *Archiv f. Gesch. d. Naturw.* VII, p. 359-376, 5. Abb., Leipzig 1916. 1818

Apropos of a mukḫula described by one ABÛ MUHAMMED 'ABD ALLÂH IBN QÂSIM IBN 'ABD ALLÂH ǰABǰÂ AL ṢIQILÎ (the Sicilian) of whom nothing is known, but that he lived before the XIIIth century. The text is translated, the instrument described and compared with other mediaeval instruments (HERMANNUS CONTRACTUS of S. XI) SEB. MÜNSTER, 1537, ATH. KIRCHER, 1671. M. BEHAIM ..). It is likely that all the late mediaeval models of portable sundials are based upon the Arabic models, which in their turn might be traced back to VITRUVIUS's « viatoria pensilia ». G. S.

Wiedemann, E. und **Hauser, F.** Byzantinische und arabische akustische Instrumente *Archiv f. Gesch. d. Naturw.*, VIII, p. 140-166. 15 Abbild. Leipzig 1918. 1818

I. Einleitung. Aeltere Schriften über Akustik. — II. Anordnungen zur automatischen Erzeugung von Tönen. — III. Schriften von MÛRIṢṬOS

(Handschriften). — Discussion of the Arabic acoustical instruments and of their Greek and Byzantine sources. Almost nothing is known of the Greek writer Mûriṭos or Mûristos, whose writings were translated into Arabic before 988, likely in S. IX. Extracts from these writings are here translated from the Arabic into German (cfr. *Isis*, III, p. 434). G. S.

Würschmidt, J. Ein türkisch-arabisches quadrant-Astrolab. *Archiv. f. Gesch. d. Naturw.*, VIII, p. 167-181, Leipzig 1918. 1918

Description of a small quadrant astrolabe bought by the author in Constantinople. G. S.

13. — ISRAEL

(See also *Bible*)

Feldman, W. M. The Jewish Child, its History, Folklore, Biology and Sociology. XXVI + 453 p., 2 pl., 19 illustr. London, Baillière Tindall, 1917. 1918

A work of much learning largely uncritical. It contains a great deal of information useful to the medical historian and folklorist. Much of the material is misplaced and, though valuable, should not have been included in this volume. Thus the title of the book would give no idea that it includes an excellent chapter on « some of the mathematical problems of the Talmud ». It is a pity that the author has not accepted further literary and scientific guidance. C. S.

Spiers F. S. Jewish contributions to science in the Middle Ages. *The Jewish Review*, p. 533. London, March 1914. 1918

A useful and well balanced short summary. C. S.

Waite, Arthur Edward. The secret doctrine in Israel, a study of the Zohar and its connections, XVI + 330 p. Boston, Occult and Modern Thought, 1914. 1918

See *Isis*, III, p. 87-88 (Masson-Oursel).

14. — JAPAN

Smith, David Eugene and **Mikami, Yoshio.** A history of Japanese mathematics, V + 288 p. Chicago, Open Court Co., 1914. 1918

See *Isis*, II, p. 410-413. (A. Reymond).

15. — MIDDLE AGES

Cotterill, Henry Bernard. Mediaeval Italy during a thousand years (305 1313). A brief historical narrative with chapters on great episodes and personalities and on subjects connected with religion, art and literature, XXVIII + 566 p., 65 pl. 6 maps. New York, F. A. Stokes [Preface dated 1915]. 1918

Very vivid and suggestive outline, well illustrated. G. S.

Loew, E. A. The Beneventan Script. A history of the South Italian minuscule, XX + 384 p. Oxford, Clarendon Press, 1914. 1918

This important monograph describes the development of a special type of handwriting. This script is important for the history of science because it

flourished in just that area that was the storehouse of the remains of Greek science. Such scientific and medical works as circulated in the Dark Ages were probably ultimately derived from this area and many of them still exist in Beneventan manuscripts. C. S.

O'Kelleher, A. and **Schoepperle, G.** Life of COLUMCILLE, compiled by MANUS O'DONNELL in 1532. LXXVIII + 516 p., Urbana, University of Illinois, 1918. 1918

A model piece of editing. An important text accessible for the first time, with English translation. Throws much light on Celtic Christian magic and the curiously unbalanced extravagance of the mediaeval Irish imagination. C. S.

Picavet, François. Un projet de publication d'œuvres philosophiques du moyen âge. *Journal des Savants*, XVII, p. 96-99. Paris 1919. 1919

Singer, Charles. Early English magic and medicine. From the *Proceedings of the British Academy*, IX. 34 p., 12 fig. London, MILFORD 1920. 1919

See *Isis*, III, p. 435-437 (SARTON).

Singer, Mrs **Dorothea Waley.** Catalogue of early scientific manuscripts in the British Isles. *Isis*, III, p. 271-274. 1920. 1919

Describing the inventory undertaken by her with the assistance of her husband, CHARLES SINGER, and other scholars. G. S.

Walsh, James J. Medieval Medicine XII + 221 p. London, BLACK, 1920.

See *Isis*, III, p. 308-309 (SINGER). SINGER having contributed a similar review of the same book to *Nature*, London April 1, 1920, Dr WALSH sent a letter of protest to the editor. Both WALSH's reply and SINGER's rejoinder were published in *Nature*, July 1. G. S.

16. — ROME

Arnold, E. V. Roman Trade Societies. *Discovery*, I, p. 55-57, London, 1920. 1918

Havell, Herbert Lord. [-1913]. Republican Rome. Her conquests, manners and institutions from the earliest times to the death of CAESAR, XXIII + 564 p., 65 pl., 12 maps. London, HARRAP, 1914. 1918

Very clear and entertaining summary of the history of ancient Rome. The account of the Punic wars is particularly vivid. After the author's accidental death the selection of the necessary illustrations was intrusted to H. B. COTTERILL; his selection is excellent. Our only criticism is that the intellectual history of Rome has been so much neglected. There is not very much to say about Roman science but we would expect at least some short account of Roman medicine, engineering, and surveying. One single paragraph is not enough to do justice to LUCRETIUS. The book should have been completed by a short critical bibliography. G. S.

PART III

Systematic Classification

The materials which could not be included in the two previous classifications — Centurial and Historical — are classified under the following headings. This third classification is exhaustive because, if any item could not be placed under the 35 first headings, it would be put under the 36th and last one : *Alia*.

1. Anatomy.
2. Anthropology.
3. Archaeology, museums and collections.
4. Art. Art and science. Iconography.
5. Arts and Crafts.
6. Astronomy, geodesy, meteorology and terrestrial physics.
7. Bibliography and libraries.
8. Biology.
9. Botany.
10. Chemistry, Physicochemistry.
11. Economics (ec. doctrines, commerce, transportation, communications).
12. Education. Methods, Colleges, Universities.
13. Ethnology. Primitive and popular science.
14. Geography.
15. Geology, mineralogy, palaeontology. Mining.
16. History of civilization. Historical methods.
17. Language and literature.
18. Logic and theory of knowledge.
19. Mathematics.
20. Mechanics.
21. Medicine :
    A. Hist. and organization.
    B. Epidemiology.
22. Morals, Moral organ. of society.
23. Pharmacy.
24. Philosophy. Science and Phil. History of Philosophy.
25. Physics.
26. Physiology.
27. Prehistory.
28. Psychology.
29. Religion.
30. Science :
    A. Bibliography.
    B. History.
    C. Organization.
    D. Philosophy.
31. Sociology, jurisprudence and positive polity.
32. Statistics.
33. Superstition and Occultism.
34. Technology.
35. Zoology.
36. Alia.

3. — ARCHÆOLOGY (museums and collections)

Deonna, Waldemar. Les Lois et les Rythmes dans l'Art (Bibliothèque de culture générale), 188 p. Paris, Flammarion, 1914. 1818

Suggestive introduction to archaeology being a summary of the author's work « L'archéologie, sa valeur, ses méthodes », 3 vol. Paris 1912 of which I wrote a long review in *Isis*, I, p. 745-754. G. S.

Morley, Sylvanus Griswold. The inscriptions at Copan, XIV + 644 p. Washington, Carnegie Institution, 1920. 1818

See *Isis*, III, p. 292-294 (Sarton).

4. — ART. ART AND SCIENCE. ICONOGRAPHY

Lavignac, Albert (*editor*). Encyclopédie de la musique et Dictionnaire du Conservatoire. Première partie : Histoire de la Musique. Premier volume : Antiquité. Moyen Age. 1 vol. in-8° (29 × 20), 618 p., 1,000 gravures et exemples de musique. Paris, DELAGRAVE, [1913]. 1818

Ce premier volume (pour l'ouvrage entier. voir *Isis*, I, p. 248) contient les contributions suivantes, assez inégales, mais importantes toutes : VICTOR LORET, Egypte; CH. VIROLLEAUD et FERNAND PÉLAGAUD, Assyrie-Babylonie; F. PÉLAGAUD, Syrie et Phrygie; ABRAHAM CAHEN, Hébreux; MAURICE COURANT, Chine et Corée (p. 77-241; étude très importante, avec un bon nombre d'exemples, un index chinois et coréen et des notes bibliographiques copieuses; datée 1912); M. COURANT, Japon (p. 242-256); JOANNY GROSSET, Inde (p. 257-376); MAURICE EMMANUEL, Grèce, art gréco-romain (p. 377-537); CAMILLE SAINT-SAËNS, Note sur les Lyres et Cythares (p. 538-540). — L'étude du moyen âge est subdivisée comme suit : les deux premières parties consacrées d'une part à la musique byzantine et au chant des églises d'Orient, d'autre part à la musique occidentale, sont dues à AMÉDÉE GASTOUÉ. Celui-ci a aussi contribué à un appendice sur les notations musicales du V^e^ au XV^e^ siècle. Une troisième partie due à P. et L. HILLEMACHER s'occupe des origines de la musique polyphonique. Période du contrepoint vocal de la fin du XI^e^ à la fin du XVII^e^ siècle. — Ce premier volume nous offre une grande masse de connaissances précieuses. Si tout l'ouvrage est construit sur le même plan, il sera vraiment monumental. Espérons que de bons index y faciliteront les recherches. G. S.

6. — ASTRONOMY, GEODESY, METEOROLOGY AND TERRESTRIAL PHYSICS

Boll, Franz. Sternglaube und Sterndeutung. Die Geschichte und das Wesen der Astrologie (Aus Natur und Geisteswelt, 638). Zweite Auflage. VIII + 112 S. mit einer Sternkarte u. 20 Abb. Leipzig, TEUBNER, 1919. 1818

The first edition of this excellent book appeared in 1917. A number of small corrections have been made in this second ed. It is out of the question to sum up a book which is itself a brief summary. It will suffice to say that no man was better qualified to write this popular exposition than BOLL and that the spirit of the book is a very generous one. He well shows that astrology was far more than horoscopy: it was a congruous and imposing philosophy of nature, as comprehensive as Scholasticism or Hegelianism. The history of astrology is also an essential part of the history of mysticism and natural religion. The first chapter on Babylonian astrology was contributed by CARL BEZOLD. The following chapters are : Development of astrol. in classical antiquity; Astrol. East and West from the time of Christ until now; Elements of the heavenly image; Astrol. methods; signification of astrol. Bibliography. Index. Chinese and Hindu astrol. are not dealt with. G. S.

Diels, Hermann. Zur Geschichte und Bedeutung der Astrologie. *Deutsche Literaturzeitung*, XXXIX, Sp. 275-282. Berlin 1918. 1818

Apropos of FR. BOLL. Sternglaube u. Sterndeutung, Leipzig 1918
G. .

Marcolongo, Roberto Il problema dei tre corpi da NEWTON (1686) ai nostri giorni (Manuali HOEPLI), VII + 166 p. Milano 1919. 1818

Third edition enlarged and corrected of a memoir first published in *Mem. d. R. Acc. d. Sci. di Napoli*, vol. XVI, and then in *Nuovo Cimento* (6), vol. IX, X. The essential bibliography is given; mathematical developments are avoided. Contents: 1. Lavori dei geometri del secolo XVIII 2. Riduzione delle equaz. differ. all'ordine minimo. 3. Problema degli *n* corpi. Casi particolari. 4. Integrali algebrici ed uniformi del problema degli *n* corpi. 5. Soluzioni approssimate per serie infinite, per serie trigonometriche. Ricerche di SUNDMANN 6. Il problema ristretto dei 3 corpi. Soluzioni periodichi. The last chapter is by far the longest (p. 92-162) and carries the history of the subject down to our own days. Excellent summary. G. S.

Müller, Franz Joh. Studien zur Geschichte der theoretischen Geodäsie, VIII + 203 p. Augsburg, Rosenaustr., 38. 1918. 1818

See *Isis*, III. p. 438-439 (SARTON).

Schoy, Carl. Längenbestimmung und Zentralmeridian bei den älteren Völkern. *Mitt. der K. K. Geogr. Gesellschaft*, Heft 1/2, 61 p. Wien 1915. 1818

History of the determination of longitudes on land by the Greeks, the Indians and the Arabs, also a study of the relative accuracy of their methods. The same author had previously devoted a similar study to the latitudes: Die geschicht. Entwicklung der Polhöhenbestimmung bei den ältern Völkern (Hamburg 1911). G. S.

7. — BIBLIOGRAPHY AND LIBRARIES

Sarton, George. Synthetic Bibliography with special reference to the History of Science. *Isis*, III, p. 159-170, 1920. 1818

1. Definitions. — 2. Analytic bibliography. — 3. Insufficiency of analytic bibliography. — 4. Synthetic bibliography. — 5. Synthetic bibliography of the history of science (this includes the scheme of classification used in *Isis*). — 6. Conclusion. The purpose of this paper is to solve the problem: « How to prepare a good bibliography of the history of science ». It may also help to solve other similar problems, or the more general one: « How to prepare a good encyclopaedic bibliography ». G. S.

8. — BIOLOGY

Driesch, Hans. The History and Theory of Vitalism. Translated by C. K. OGDEN. Revised and partly rewritten for the English edition by the author, VIII + 239 p. London, MACMILLAN, 1914. 1818

See *Isis*, III, 439-440 (SARTON).

Noll, Alfred. Die Lebenskraft in den Schriften der Vitalisten und ihrer Gegner (VOIGTLAENDERS Quellenbücher, 69), 86 S. Leipzig, VOIGTLÄNDER, [1914]. 1818

1. Abschnitt. Aus der Zeit des Vitalismus: F. C. MEDICUS (1774), J. D. BRANDIS (1795), GEORG PROCHASKA (1797), JOH. CHRIST. REIL (1796), TH. GEO. AUG. ROOSE (1778) — FR. HILDEBRANDT (1803), TREVIRANUS (1802), J. F. ACKERMANN (1805), K. A. RUDOLPHI (1821), J. H. F. AUTENRIETH

(1836), Joh. Müller (1844). — 2. Abschnitt. Gegner der Lebenskraft : F. Magendie (1834), Lotze (1842), J. Schleiden (1845), E. du Bois-Reymond (1848), L. Büchner (1855), R. Virchow (1856), M. Verworn, Lud. Hermann. Driesch not quoted. No index. G. S.

Appert, Dr. L'hérédité morbide, 306 p., Paris, Flammarion, 1919. 1918

See *Isis*, III, p. 295 (Guinet).

Blaringhem, Louis. Les problèmes de l'hérédité expérimentale, 317 p. Paris, Flammarion, 1919. 1918

See *Isis*, III, p. 295-296 (Guinet).

Grasset, Joseph. [1849-1918]. Devoirs et périls biologiques, 546 p. Paris, Alcan, 1917. 1918

See *Isis*, III, p. 88 (Guinet).

Grasset, Joseph. La Biologie humaine, 344 p. Paris, Flammarion, 1917. 1918

See *Isis*, III, p. 88 (Guinet).

Grasset, Joseph. Le dogme transformiste, 158 p. Paris, Renaissance du Livre, 1919. 1918

See *Isis*, III, p. 88 (Guinet).

Guilleminot, H. La matière et la vie, 318 p. Paris, Flammarion, 1919. 1918

See *Isis*, III, p. 296-297 (Guinet).

Legrand, L. La sélection du plasma spécifique. Esquisse d'une théorie cytomécanique et cytochimique de la vie, 187 p. Paris, Maloine, 1916. L'emboîtement des plasmas. Aperçu d'une théorie mécanique de l'hérédité. *Revue générale des sciences*, XXVIII, p. 368-376, 396-403 p. Paris, 1917. Les caractères biochimiques de l'espèce. *Ibidem*, XXIX, 333-340, 1918. Une conception biologique nouvelle de la cellule. *Ibidem*, XXX, 397-408, 1919. 1918

See *Isis*, III, p. 88-89 (Guinet).

Loeb, James. Natural death and the duration of life. *Scientific Monthly*, IX, p. 578-585. Lancaster, Pa. 1919. 1918

Based on the exper. of Loeb and Northrop on the duration of the life of flies at various temperat., and on those of Gudernatsch, Allen, Uhlenhuth, Loeb on the duration of larval period of frogs, salamanders, axolotls and flies. The duration of life and of the larval period (or of youth) is the time required for the completion of a series of chemical reactions. Hence any agent which modifies the speed of these reactions, will affect the duration of life correspondingly. G. S.

9. — BOTANY

(Agronomy, Phytopathology, Palaeobotany)

Harvey-Gibson, R. J. Outlines of the history of botany, x+274 p. London, Black, 1919. 1918

See *Isis*, III, p. 297-299 (Singer).

Laufer, Berthold. Sino-Iranica. Chinese contributions to the history of civilization in ancient Iran, with special reference to the history of cultivated plants and products. Chicago, 1919. 1818

See *Isis*, III, p. 299-302 (SARTON).

Verzeichnis der Landwirtschaftlich-geschichtlichen Austellung zu Vippach-Edelhausen, 11-14 Februar 1917, veranstaltet vom Landwirtschaftlichen Verein daselbst aus Anlass seines 25 jährigen Bestehens. 12 S. 1818

Catalogue of a small exhibition of objects, books and manuscripts relating to the history of husbandry: the first exhibition of this kind of which I have heard; largely due to the efforts of Dr MAX GÜNTZ about whom see *Isis*, II, p. 141. Divided as follows: 1. Acker- u. Spanngeräte (11, all XIXth cent.). 2. Handgeräte u. Aehnliches (31, all XIXth except 3 XVIIIth cent.). 3. Haus wirtsch. Gegenstände (44, all XIXth except 3 XVIIIth cent.) 4. Spinnen und Weben. Kleidungsstücke. Frauenhandarbeit (32, all XIX except 4 XVIIIth cent.). 5. Bücher, Zeitschr. u. Karten (55). 6. Urkunden u. Hdsch. (38). 7. Bilder u. Karten (27). 9. Vorgeschicht. Funde u. andere Ausgrabungen (6). 10. Sonstige Altertümer (11). G. S.

10. — CHEMISTRY. PHYSICOCHEMISTRY

Hjelt, Edv. Geschichte der organischen Chemie von ältester Zeit bis zur Gegenwart, XII+556 S. Braunschweig, VIEWEG, 1916. 1818

See *Isis*, III, p. 440-443 (SARTON).

Lespieau, R. La molécule chimique, 286 p. Paris, ALCAN, 1920. 1818

See *Isis*, III, p. 427-428 (GUINET).

Letts, E. A. Some fundamental problems in chemistry, old and new, XIII+235 p., 44 fig. London, CONSTABLE, 1914. 1818

See *Isis*, III, p. 443 (SARTON).

Library of Congress. List of references on Dyestuffs. Chemistry, Manufacture, Trade. Compiled under the direction of HERMAN H. B. MEYER, 186 p. Washington, Government Printing Office, 1919. 1818

List of 1650 books and articles divided in two parts — the first devoted to bibliographies (10 *items*), the second to all the rest, classified alphabetically by author names. It represents the material in the Library « with considerable additions of references to highly technical literature found elsewhere ». A very detailed subject index considerably increases the value of this list. Yet it is not a scientific list, since it is uncritical, all items being put on the same level. Of hardly any interest to the historian (at least now), it may prove very valuable to the chemist and the business man. G. S.

Lippmann, Edmund O. von Entstehung und Ausbreitung der Alchemie. Mit einem Anhange: zur älteren Geschichte der Metalle, XVI+742 p. Berlin, SPRINGER, 1919. 1818

See *Isis*, III, p. 302-305 (SARTON).

Niemann, W. Die ersten chemischen Feuerzeuge. *Archiv f. Gesch. d. Naturwis.*, VII p. 299-309, 390-403, Abb., Leipzig 1916. 1818

Lewis, W. C. Mc C. Radiation, the fundamental factor in all chemical change. *Scientia*. XXV p. 450-459. Bologna 1919. 1818

Plotnikow, J. Ueber die photochemische Valenz und die Lichtempfindlichkeit der Körper, 36 S. Vereinigung wissenschaftlicher Verleger, Berlin 1920. 1818

A chapter of the author's « Lehrbuch der allgemeinen Photochemie » of which Bd. I. Lichtreaktionen is in the press, same publishers. G. S.

11. — ECONOMICS

(Economic doctrines and history, Commerce, Transportation, Communications.)

Review of Economic Statistics and Supplements. Preliminary vol. I, in-fol., 38 cm., 323 + 129 (Index). HARVARD University Committee on Economic Research. HARVARD University Press, Cambridge, Mass. 1919. 1818

The editor is Prof. W. M. PERSONS of Harvard University ; the purpose is « to promote the collection, criticism and interpretation of economic statistics... This it will seek to do by investigation of the sources and probable accuracy of existing statistical data, by the collection of additional data in cases where this may prove desirable and practicable, and by developing the application to economic statistics of modern methods of statistical analysis which have hitherto been utilized more extensively in other sciences than in economics ». G. S.

12. — EDUCATION

(Methods, Colleges, Universities)

Mieli, Aldo. Pedagogisti ed educatori antichi e moderni. *Isis*, II, p. 399, 1919. 1818

Short note to announce the publication of a new collection edited by GIUSEPPE LOMBARDO-RADICE and published by SANDRON, Palermo. G. S.

13. — ETHNOLOGY

(Primitive and popular science)

Hambruch, Paul. Die Wasserversorgnung bei den Eingeborenen der Südsee. *Geschichtsbl. f. Technik u. Industrie*, VI, p. 60-65, 5 Abb. Berlin 1919. 1818

Lowie, Robert H. Culture and Ethnology. 190 p. New York, DOUGLAS C. MC MURTRIE, 1917. 1818

Four essays on the methods and the signification of ethnology entitled : Culture and psychology ; culture and race ; culture and environment ; the determinants of culture. A fifth essay far longer (p. 98-180) and more technical on Terms of relationship. Bibliography. G. S.

Wissler, Clark. The American Indian. An introduction to the anthropology of the new world. XIV + 435 p., 104 ill. New York, DOUGLAS C. MCMURTRIE, 1917. 1818

General summary of antropological research in the Americas, — the most

comprehensive and up-to-date available at present — by the Curator of Anthropology of the American Museum of Natural History. (Anthropology is here meant to include ethnology and archaeology as well as somatology). Contents : The food areas of the new world. Domestication of animals and methods of transportation. Textile arts. Ceramic arts. Decorative designs. Architecture. Work in stone and metals. Special inventions. Fine arts. Social grouping. Social regulation. Ritualistic observances. Mythology. Classification of social groups according to their cultures. Archaeol. classif. Chronology of cultures. Linguistic classif. Somatic classif. Correlation of classif. Theories of culture origins. New world origins. Linguistic tables. Bibliography. Very elaborate index. G. S.

14. — GEOGRAPHY

Baer and Co., **Joseph**. Afrika. Seine Geschichte, Geographie, Ethnographie, Kunst, Kultur- und Naturgeschichte, Sprachen und Literaturen mit Einschluss allgemeiner Werke über diese Gebiete Antiquariats-Katalog 663, S. 149, 2060 Nrn.
Frankfurt am Main, Hochstr. 6, [1920?] 1818

Wolkenhauer, W. Zeitliche Entwicklung und Eigenschaften der Kartenprojektionen. *Kartographische u. schulgeogr. Zeitsch*, VI, 185-187. Wien 1917. 1818

Chronoligical summary of the development of map projection with a few bibliographic notes. G. S.

15. — GEOLOGY, MINERALOGY, PALAEONTOLOGY

Metzger, Hélène. La genèse de la science des cristaux, 248 p , Paris, Alcan, 1918. 1818

See *Isis*, III, p. 445-446 (Guinet).

Ruska, Julius. Methodik des mineralogisch-geologischen Unterrichts, VIII + 520 p., 35 Abb., 1 Taf. Stuttgart, Enke, 1920. 1818

See *Isis*, III, p 443-444 (Sarton).

Sarton, George. La synthèse géologique de 1775 à 1918. *Isis*, II, p. 357-394, 2 pl. 1919. 1818

I. Progrès de la synthèse géologique. II. Les cartes géologiques. Les organisations nationales. III. Les cartes géologiques. L'organisation internationale. IV. La face de la Terre. V. Eduard Suess. VI. Bibliographie de l'histoire et de la synthèse géologiques.

Le chapitre II contient une liste des principales cartes géologiques de 1684 à 1912 et une liste chronologique des principaux services géologiques nationaux. P. 382 l. 7 lire « analyse, synthèse, analyse, synthèse » au lieu de « analyse, synthèse ». G. S.

16. — HISTORY OF CIVILIZATION

General history. Historical methods. Biography and Chronology

Coulton, C. G. Social life in Britain from the Conquest to the Reformation, XVI + 540, 5 pl. Cambridge, University Press, 1918. 1818

A series of translations of typical passages from the manuscript literature by one of the most accomplished living mediaevalists. The sections on « Medicine and Justice » and « Superstitions and Marvels » contain material of interest to historians of science. C. S.

Osler, Sir William. The Old Humanities and the New Science. With introduction by HARVEY CUSHING. XXII + 64 p., 1 portrait. Boston, HOUGTON MIFFLIN, 1920. 1818

Reprint of the memorable presidential address delivered by Sir WILLIAM before the Classical Association at Oxford on May 16, 1919. This address was really Sir WILLIAM 's « Chant du cygne » and his many friends all over the world will love to have it as beautifully printed and in book form. OSLER's ideas are substantially the same as those of the New Humanism, to which movement explicit reference is made on p. 55. On the occasion of this address, an exhibition of instruments and objects illustrating the History of Science at Oxford had been prepared. (See p. XIII, 58). G. S.

Sarton, George. War and Civilization. *Isis*, II, p. 315-321. 1919. 1819

Reflexions on the great war and reassertion of the ideal of the New Humanism. The internationalism of *Isis* is explained. A letter on this subject, originally printed in the New York Evening Post of Febr. 22, 1919, is reprinted. G. S.

Sarton, George. The Faith of a Humanist. *Isis*, III, p. 3-6, 1920. 1818

Explaining at the threshold of a new volume of *Isis*, the ideal of the New Humanism. G. S.

[**Sarton, George.**] The Unity History Schools at Woodbrooke near Birmingham, *Isis*, III, p. 419, 192. 1818

Short note on the fourth course of lectures organized by F. S. MARVIN at Woodbrooke. this time in conjunction with the League of Nations Union. G. S.

Sidersky, D. Note sur la chronologie samaritaine. *Journal Asiatique*, X, p. 513-532. Paris 1917. 1818

Tille, Armin (*editor*). Weltgeschichte begründet van HANS F. Helmholt. Zweite neubearb. u. verm. Auflage, 3. Band : Afrika, Pyrenäenhalbinsel, Altgriechenland, XIV+584 p , 8 Kart , 30 Taf., 164 Abb. Leipzig, Bibliographisches Institut, 1914. 1818

See *Isis*, II, p. 428 (SARTON).

17. — LANGUAGE AND LITERATURE

Meillet, A. La langue et l'écriture. *Scientia*, XXVI, 290-293. Bologna 1919. 1818

« C'est la structure de la langue qui a conditionné chaque invention décisive dans le développement de l'écriture. »

18. — LOGIC AND THEORY OF KNOWLEDGE

Goblot, Edmond, Traité de Logique. Préface de M. EMILE BOUTROUX, XXIII+412 p., Paris, COLIN, 1918 1818

See *Isis*, III, p. 306-307 (SARTON).

Russell, Bertrand. Our knowledge of the external world as a field for scientific method in philosophy, x + 245 p. Chicago, Open Court Co., 1914. 1818

See *Isis*, III, p. 311-314 (JOURDAIN).

19. — MATHEMATICS

Archibald, Raymond, C. Historical note on centers of similitude of circles. *American mathematical monthly*, XXIII, p. 159-161, 1916. 1918

Bussey, W. H. The origin of mathematical induction. *American mathematical monthly*, XXIV, p. 199-207, 1917. 1918

Discussion of the use of this method, in effect, by MAUROLYCUS and by PASCAL, with some of its recent applications. L. C. K.

Cajori, Florian. Origin of the name. « mathematical induction. » *American mathematical monthly*, XXV, p. 197-201, 1918. 1918

The *process* was used by BERNOULLI (JAKOB), PASCAL and MAUROLYCUS, and a modification by CAMPANUS in 1260, in his EUCLID, and a similar modification by FERMAT. The name « mathematical induction » applied to the argument from n to $n+1$ used first by DE MORGAN in the « Penny Cyclopedia, » 1838. L. C. K.

Cajori, Florian. What is the origin of the name « Rolle's Curve » ? *American mathematical monthly*, XXV, p 290-292, 1918, 1918

The question remains unanswered. L. C. K.

Cajori, Florian. The controversy of the origin of our numerals. *Scientific monthly*, IX, p. 458-464, 1919, 1918

Review of recent theories, chiefly those of KAYE and CARRA DE VAUX. CAJORI'S conclusion is in a favour of the Hindu origin, admitting however that the earliest reliable evidence does not go further back than S. IX. The earliest reliable record of the use of our numerals with the zero is an inscription of 367 A.D. in India. G. S.

Cajori, Florian. The history of ZENO's arguments on motion ; Phases in the development of the theory of limits. *American mathematical monthly*, XXII, p. 1-6, 39-47, 79-82, 109-115, 143-147, 179-186, 215-220, 253-258, 292-297, 1915. 1918

This somewhat elaborate discussion of the paradoxes of ZENO includes a statement of the purpose of ZENO's arguments, ARISTOTLE'S exposition and criticism and an account of the discussion continued in Greek, Roman, medieval and modern times ; the paper concludes with a discussion of the paradox in the light of an idealistic continuum, and with post-Cantorian dissensions. This work is of great value for the history of certain phases of the calculus, as well as for the history of philosophy. The bibliographical references and citations will be found especially useful as they cover a wide range of literature in many fields. L. C. K.

Carmichael, R. D. FERMAT Numbers, $F_n = 2^{2^n} + 1$, *American mathematical monthly*, XXVI, p. 137-146, 1919. 1918

Brief account with historical notes and with discussion of the properties of such numbers. L. C. K.

Dickson, Leonard Eugene. History of the theory of numbers. Vol. I. Divisibility and Primality, XII+486 p. Washington, CARNEGIE Institution, 1919. 1918

See *Isis*, III, p. 446-448 (J. M. CHILD).

Hill, M. J. M. The Theory of Proportion, xx + 108 p. London, Constable, 1914. 1918

See *Isis*, III, p. 307 (Jourdain).

Kaye, G. R. L'origine de notre notation numérique. *Scientia*, XXIV, p. 53-55. Bologna 1918. 1918

Review of his own writings on the subject apropos of a paper of Carra de Vaux, 1917 (see *Isis*, III, p. 141). Kaye shows the convergence of his and of Carra de Vaux's arguments against the Indian origin of our numerals. G. S.

Löffler, Eugen. Ziffern und Ziffernsysteme, 2te, neu bearb. Aufl. (Mathematische-physikalische Biblioth., Bd. 1 u. 34) 54 + 60 p. Leipzig, Teubner, 1918-1919. 1918

This second ed. of Löffler's book is entirely remade and appears now in 2 pamphlets instead of 1. Popular but scholarly and comprehensive exposition divided as follows. Vol. I : Signification of numerals; Origins; Egypt; Mesopotamia; Greece; Semitic peoples. — Vol. II : Roman numerals; the principle of position and zero; India; Development of our numerals in the Arabic and the Christian worlds; Far East; Synoptic tables. G. S.

Loria, Gino. Le matematiche in Ispagna ieri ed oggi. Parte 1ª : Dal secolo xvi alla metà del xix. Parte IIª : I matematici moderni, *Scientia*, XXV, p. 353-359, 441-449. Bologna 1919. 1918

Miller, G. H. History of mathematics, *American mathematical monthly*, XXII, p. 299-304, 1915. 1918

Account of some recent publications in mathematics, with a plea for the study of the history of modern mathematics as opposed to the mathematics of the past. L. C. K.

Slocum, S. E. The romantic aspect of numbers. *Scientific monthly*, VII, p. 68-79. Lancaster, Pa., 1918. 1918

Slocum shows the important rôle played by number symbolism in the development of mankind. G. S.

Smith, David Eugene. On the origin of certain typical problems. *American mathematical monthly*, XXIV, p. 64-71, 1917. 1918

Historical discussion of the cistern problem, the « Josephs-spiel », the testament problem involving posthumous twins, and the hare and the hound or couriers, with variants. L. C. K.

Weaver, James H. The Duplication Problem. *American mathematical monthly*, XXIII, p. 106-113; 1916. 1918

Brief account of the duplication problem, largely following Pappus for its ancient history. L. C. K.

The American mathematical monthly.

Founded in 1894, by B. F. Finkel and J. M. Colaw, Editors, as a journal to be devoted to the field of elementary mathematics. A special feature of the journal was the inclusion of several problem departments. For ten years the journal continued under the editorship of the original editors; then

for nine years under the editorship of B. F. FINKEL jointly with a series of other mathematicians including, among others, for varying periods of service, LEONARD DICKSON, H. E. SLAUGHT and G A. MILLER. For three years, 1913-1916, the journal was published with the financial cooperation of a group of American Universities and Colleges, edited by a group of representatives of these institutions. With 1917, the Monthly became the official organ of the Mathematical Association of America, a society formed at that time for the purpose of reaching those interested in the field of collegiate mathematics. The editor-in-chief was, for one years, H E SLAUGHT of Chicago University, for one year R. D. CARMICHAEL of the University of Illinois, and since 1919, is R. C. ARCHIBALD of Brown University. — Published at Lancaster, Pa. L. C. K.

Peano, G. Importanza dei simboli in matematica, *Scientia*, XVIII, p. 165-173. Bologna 1915. 1818

Rey Pastor, J. La systématisation de la géométrie au moyen de la théorie des groupes. *Scientia*, XXIII, p. 413-422. Bologna 1918. 1818

20. — MECHANICS

Amaduzzi, Lavoro. Le principe de relativité. *Scientia*, XXIV, p. 239-243, 321-336. Bologna 1918. 1818

Revue générale de travaux récents, divisée comme suit : 1. L'immobilité de l'éther et l'hypothèse conciliatrice de LORENTZ ; 2. La formule de LORENTZ de transformation des coordonnées et les généralisations subséquentes d'EINSTEIN. G. S.

Ames, J. S. EINSTEIN's Law of Gravitation. *Science*, LI, p. 253-261. New York, March 12, 1920. 1818

Palatini, Attilio La teoria di relatività nel suo sviluppo storico. *Scientia*, XXVI, p. 195-207, 277-289. Bologna 1919. 1818

21. — MEDICINE

A. — *History, Organization and Philosophy*

Congress (First) of the History of Medicine (Antwerp, August 1920). *Isis*, III, p. 268, 1920. 1818

Preliminary note, very short.

Lint, J. G. de. Geneeskundige Volksprenten in de Nederlanden, 122 bl., met 78 afbeeldingen naar oude prenten. Gorinchem, J. Noorduyn en Zoon, 1918. 1818

Collection of medical popular prints of the Netherlands with explanatory texts. This collection was made easier by the old Dutch trait of making what they call « historische atlassen », that is family collections of prints put together in an album. The classification of the 78 prints here reproduced — rather poorly — is as follows : Prints relating to political events ; Cartoons of physicians ; Strange pathological cases ; Calculi ; Giants and dwarfs ; Monstrosities ; Quacks. The last chapter is devoted to a famous collection of prints « Tafereel der dwaasheid » (1720) — of which there are many copies but hardly two alike ; it is a tableau of human stupidity under its various forms. G. S.

Smith. Sir F. The early history of veterinary literature and its British development, vol. I, IV + 373 p. London, BAILLIERE TINDALL, 1919. 1818

See *Isis*, III, p. 307-308 (SINGER).

24. — PHILOSOPHY. SCIENCE AND PHILOSOPHY. HISTORY OF PHILOSOPHY.

Grasset, Joseph [1849-1918]. L'idéalisme positif. *Revue philosophique*, février et mars. Paris 1917. 1819

See *Isis*. III, p. 88 (GUINET).

Grasset, Joseph. Science et philosophie, 179 p. Paris, Renaissance du livre, 1918. 1818

See *Isis*, III, p. 88 (GUINET).

Sageret, Jules. La vague mystique, 180 p. Paris, FLAMMARION, 1920 1818

See *Isis*, III, p. 448-449 (GUINET).

25. — PHYSICS

Magrini, Silvio. I fenomeni magnetici nelle varie teorie elettromagnetiche. Note storico-critiche, 166 p. Bologna, ZANICHELLI, 1912. 1813

See *Isis*, II, p. 427-428 (MIELI).

Nippoldt, A. Ein Beitrag zur Frage der Ausrichtung der Kirchenachsen mit dem Magneten. *Archiv f. Gesch. d. Naturwiss*., VII, p. 109-114, 236-244. Leipzig 1916. 1818

An interesting contribution to the history of magnetic declination.
G. S.

Rougier, Louis. La matérialisation de l'énergie. Essai sur la théorie de la relativité et sur la théorie des quanta, XII + 148 p. Paris, GAUTHIER-VILLARS, 1919. 1818

Summary of the latest physical theories, very full, very critical and written with characterically French luminosity. Short bibliography. Should be translated into English. G. S.

26. — PHYSIOLOGY

Lillie, Ralph S. Suggestions for physical investigations bearing upon fundamental problems of physiology and medicine. *Science*, LI, p. 525-528, New York, 1920. 1818

The fundamental questions are : what kind of a system, in the physico-chemical sense, is living protoplasm ? and what are the conditions of normal self-maintenance of such a system ? G. S.

Oppenheimer, Carl. Kleines Wörterbuch der Biochemie und Pharmacologie, II + 228 p. Berlin, Verein. Wissensch. Verleger, 1920. 1818

The best way to give an idea of this dict. is to take at random two

columns and quote the articles which they contain : Garouille, Garrya, Gartenkresse, Gasteria, Gastrin, Gastrolobium, Gastrosan, Gaswechsel, Gaultherase, Gaultheria, Gease, Gedrovan, Geissospermin, Geissospermum, Gelaphal, Gelase, Gelastoide — Vinca, Vinel, Vinopyrin, Vinyl, Viola, Violaquercitrin, Vioform, Violenwurzel, Vipera, Virilin, Virola, Visalban, Viscin, Viscolan, Viscum, Vismia, Visvit, Vitamine. The average length of each article is 15 words ; hence one cannot expect to find much information in this book. Yet it may prove useful as vocabulary and memento. No historical matter. G. S.

27. — PREHISTORY

Klaatsch, Hermann. Die Anfänge von Kunst und Religion in der Urmenschheit. 30 Abbild., 63 p. Leipzig, UNESMA, 1913. 1818

Hrdlička, Aleš. Early Man in South America. Bureau of American Ethnology, Bull. 52, xv+405 p., 68 pl., 51 fig. Washington, Government Printing Office, 1912. 1818

The Bull. 33 of the Amer. Bureau of Ethn. (1906) contained a study by the same author entitled « Skeletal remains suggesting or attributed to early man in North America ». The present Bull. offers us the results of a similar enquiry, equally thorough, on *South*-American palaeoanthropology. Geologic information is provided by BAILEY WILLIS; petrographic, by F. E. WRIGHT and C. N. FENNER, archaeological by W. H. HOLMES. The author's conclusions are the same as those reached in his first inquiry. He has found no evidence of human remains of great antiquity. « The facts gathered attest everywhere merely the presence of the already differentiated and relatively modern American Indian. » Tangible traces of either geologically ancient man himself or of any precursors of the human race have not been brought forth thus far either in North or in South-America. G. S.

29. — RELIGION. HISTORY OF RELIGION. RELIGION AND SCIENCE

Moore, George Foot. History of Religions. I. China, Japan, Egypt, Babylonia, Assyria, India, Persia, Greece, Rome. Revised edition with corrections and additions, xiv+651 p. New York, SCRIBNER, 1920. 1818

Minor corrections throughout, more considerable changes in the chapters on Japanese Buddhism and on Hinduism. Addenda, including Suppl. to the Literature, p. 603-616. The first ed. appeared in 1913. The first ed. of vol. II appeared in 1919 (*Isis*, III, p. 367). G. S.

30. — SCIENCE

B. — *History*

Caverni, Raffaello. [San Quirico presso Montelupo 1837-1900]. — ALDO MIELI, L'opera di R. C. come storico; GIOVANNI GIOVANNOZZI. R. C. e la sua storia del metodo sperimentale; CARLO DEL LUNGO. La storia... di R. C ; ANT. FAVARO. GALILEO GALILEI, BENEDETTO CASTELLI e la scoperta delle fasi di Venere. *Archivio di Storia della Scienza*, I, p. 262-296. Roma 1920. 1818

The Rev. RAFF. CAVERNI, for thirty years rector (parroco) of San Bartolomeo in Quarata (com. di Bagni a Ripoli) wrote a « Storia del metodo speri-

mentale in Italia » of which only 5 1/2 vol. out of 10 have appeared (1891-1900). This book contains an enormous material, but is so badly composed, so badly written, so badly got up and so full of prejudices (chiefly antigalileian) that its practical value is but small. Yet it is a great work and it is worth while to criticize it, because (1) criticism will limit our distrust and hence increase the value of the book ; (2) prepare the elaboration of a better history. MIELI writes a general introduction, with portrait, biogr. and bibliogr. notes; GIOVANNOZZI and DEL LUNGO contribute general appreciations and FAVARO, a criticism of CAVERNI with reference to a special topic. More essays will appear later. Excellent idea ! G. S.

Crew, Henry. The problem of the history of science in the college curriculum. *The Scientific Monthly*, May, p. 475-481. New York 1920. 1918

Paper read before the American Historical As., Cleveland, 1919 The history of science is now the « ugly duckling » of the college curriculum. CREW does not believe in the possibility of teaching well the history of science and would prefer to it courses on the history of zoology, botany, physics and chemistry given by four different scientists, or more exactly general introductory courses a large part of which would be historical. Science should be presented not in an impersonal and dogmatic way, but as a human achievement. The teachers intrusted with these historical courses should be about forty years of age or older. G. S.

De Sarlo, Francesco. La storia della scienza e la psicologia. *Archivio di storia della scienza*, I, p. 253-261, Roma 1920. 1918

Insists on the psychologic aspect of the history of science. G. S.

Goblot, Edmond. GASTON MILHAUD (1858-1918). *Isis*, III, p. 391-395, 1921. 1918

Bio- and bibliographical note and short study of MILHAUD's important contributions to the history and to the philosophy of science. MILHAUD was one of the first contributors to *Isis*; he was a genuine humanist. G. S.

Laurent Gaston. Les grands écrivains scientifiques de COPERNIC à BERTHELOT. Extraits, introduction, biographies et notes. 5e éd. XI + 384 p. Paris, COLIN, 1913. 1913

See *Isis*, II, p. 424-425 (TURRIÈRE).

Mieli, Aldo (*editor*). Archivio di Storia della Scienza. Roma, ATTILIO NARDECCHIA, 1919. 1919

See *Isis*, III, p. 59 (SARTON).

Mieli, Aldo (*editor*). Gli Scienziati Italiani dall' inizio del medio evo ai nostri giorni. Roma, NARDECCHIA (*in preparation*). 1918

See *Isis*, III, p. 59-60 (SARTON).

[Sarton, George]. Avant-Propos. *Isis*, II, 313-314. Bruxelles 1919. 1913

Preface explaining why the publication of *Isis* was interrupted during five years and stating new policy. G. S.

Sarton, George. History of Science in America. *Isis*, III, p. 274-276, 1920.

Notes about (1) the conference on the history of science at Cleveland.

Dec. 31 1919; (2) the Wireless Telephone exhibition organized by the National Research Council, the American Telephone and Telegraph C° and the Western Electric Co; (3) the celebration of the centenary of the Discovery of Electromagnetism (1820) at the Northwestern University, Evanston, Illinois. G. S.

Sarton, George. Synthetic bibliography with special reference to the History of Science. *Isis*, III, p. 159-170, 1920. 1818

See under Bibliography, p. 483.

Sarton, George. The history of science. *Monist*, XXVI, p. 321-365. Chicago 1916. 1818

See *Isis*, III, p. 310-311 (JOURDAIN)

Sarton, George. IV° Bibliographie analytique de toutes les publications relatives à l'Histoire et à l'Organisation de la Science. *Isis*, I, 715-791. Wondelgem 1914. — V° Bibliographie critique de toutes les publications relatives à l'Histoire, la Philosophie et l'Organisation de la Science. *Isis*, II, p. 248-310. Wondelgem 1914. — VI° Bibliographie critique... *Isis*, II, p. 429-480. Bruxelles 1919. — Seventh Critical Bibliography of the History, Philosophy and Organization of Science and of the History of Civilization. *Isis*, III, p. 90-154. Brussels 1920. — Eighth Critical Bibliography... *Isis*, III, p 316-371. Brussels 1920. — Ninth Critical Bibliography... *Isis*, III, p. 451-497. Brussels 1921. 1818

The	IV^th^ Bibliogr.	closed Jan. 1914,	contains about	422 notes.
—	V^th^ —	May 1914	—	840 —
—	VI^th^ —	August 1914	—	510 —
—	VII^th^ —	June 1919	—	815 —
—	VIII^th^ —	April 1920	—	490 —
—	IX^th^ —	August 1920	—	365 —

Some of the notes of these bibliographies have been contributed by other scholars, to wit, the late PH. E. B. JOURDAIN, ALDO MIELI, ERNST BLOCH, GINO LORIA, CHARLES SINGER and L. C. KARPINSKI. A good number of publications which appeared during the war have not yet been recorded, the editor having been thus far unable to see them. He hopes to be able to complete this bibliography and bring it uptodate by the end of 1921. The total number of notes published in vol. I, II and III is respectively *about* 2600, 1350 and 1670. The number has become relatively smaller because the selection is more rigorous; the notes are much longer too. Yet this bibliography is still very unsatisfactory. G. S.

[Singer, Charles]. Courses on the history of science at University College, London. *Isis*, III, p. 419-420, 1920. 1818

Short note on the courses provided for summer term 1920.

C. — *Organization*

Associations for the advancement of science (The scope of the). Editorial in London *Times*, Sept. 15, 1919. 1818

Extract of it reprinted with brief commentary in *Isis*, III, p. 62. G. S.

Discovery. A monthly popular Journal of Knowledge, edited by A. S. RUSSELL. London, MURRAY, 1920. 1818

See *Isis*, III, p. 309-310 (SARTON).

Lallemand, Ch. Les nouvelles unités légales de mesures industrielles (système M. T. S., unités géométriques, mécaniques, électriques, caloriques et optiques). Annuaire pour l'an 1920 publié par le Bureau des longitudes. Notice B, 64 p. Paris, GAUTHIER-VILLARS. 1919

Revue Générale des Sciences. Isis, III, p. 270-271, 1920. 1919

Short note to commemorate the 25th anniversary in 1914, of this excellent review founded in 1890 by LOUIS OLIVIER. An excellent table to the 25 first volumes was published in 1914, being a part of vol. XXV (1914). G. S.

Sarton, George. The International Organization of Science. *Isis*, III, p. 420 421, 1921. 1919

Explaining the plans which are being made to centralize intellectual international activities in Brussels, Belgium. There would then be three international centers or clearing-houses. A politic and administrative center in Geneva, Switzerland; a juridic center in The Hague, Netherlands and an intellectual center in Brussels, Belgium. G. S.

32. — STATISTICS

Belot, Emile. Le danger de l'application du calcul des probabilités aux sciences de la nature et en particulier à l'astronomie. *Scientia*, XXVI, p. 242-246. Bologna 1919. 1919

« On n'a pas le droit d'appliquer la théorie des erreurs là où l'hypothèse du hasard imposée gratuitement aux phénomènes ne sert qu'à dissimuler notre ignorance des réalités. »

Huntington, Edward V. Mathematics and statistics, with an elementary account of the correlation coefficient and the correlation ratio. *American mathematical monthly*, XXVI, p. 421-435, 1919. 1919

33. — SUPERSTITION AND OCCULTISM

Butler, Hiram E. [1841-]. Solar Biology. A scientific method of discerning character, diagnosing disease, determining mental, physical and business qualifications, conjugal adaptability, etc., from date of birth. 23d. ed., illustr., portrait, XL+288+206 p. Esoteric Publishing Co., Applegate, Cal., 1920. 1919

See *Isis*, III, p. 449-450 (SARTON).

34. — TECHNOLOGY

(For mining, see geology; for industrial chemistry, chemistry. See also arts and crafts)

Decker, Wilbur F. The Story of the Engine from lever to Liberty motor, XX+277 p., illustr. New York, SCRIBNER'S, 1920. 1919

This is the story, not the history, of the engine yet it is noticed here because the author has frequently used the historical method of approach as being the most natural and the easiest. The exposition is remarkably clear, simple and well illustrated. Contents : Elementary machines. — Early steam-engines. — Steam-boilers, furnaces and connections. — Reciprocating engines. — Locomotives. — Steam-turbines. — Measurements of power. — Gas-engines. — Gasoline-engines. — Oil-engines. — Index. Excellent introduction to the subject for the non-technical reader. G. S.

De Leener, G. Sur les modifications imposées par le milieu contemporain à l'élaboration des inventions techniques. (Archives sociologiques, n° 438). *Bulletin de l'Institut de sociologie* SOLVAY, n° 33, p. 1035-1040. Bruxelles 1914. 1918

A propos du livre de R. DIESEL. Die Entstehung des Dieselmotors Berlin 1913.

Diels, Hermann. Antike Technik. Sieben Vorträge. 2te erw. Auflage. VIII+243 p., 19 Taf. Leipzig, TEUBNER, 1920. 1918

See *Isis*, III, p. 433-434 (SARTON).

Fischer, Hermann. Beitraege zur Geschichte der Werkzeugmaschinen. *Beitr. z. Gesch. d. Technik u. Industrie*, V, p. 73-123, 107 Abb. Berlin 1913. 1918

Spanabhebende Werkzeugmaschinen mit geradem Hauptweg (Metallhobelmaschinen). Die Führungen der Werkzeugmaschinen. Maschinen zum Erzeugen vierkantiger Löcher in Holz oder Stemmmaschinen. Grenzlehren. G. S.

Koehne, Carl. Die Mühle im Rechte der Völker. *Beitraege zur Geschichte der Technik und Industrie*, V, p. 27-53. Berlin 1913. 1918

Möteſindt, Hugo. Die Erfindung des Drehschemels am vierrädrigen Wagen. Mit 7 Abb. *Geschichtsblätter für Technik u. Industrie*, VI, p. 30-41. Berlin 1919. 1918

Petrie, W. M. Flinders. Tools and Weapons illustrated by the Egyptian collection in University College, London, and 2 000 outlines from other sources, VII+73 p., 83 pl. London, University College, 1917. 1918

See *Isis*, III, p. 314-315 (SARTON).

35. — ZOOLOGY

Garboe, Axel. Der Strauss in der Geschichte der Naturwissenschaften *Archiv für Gesch. d. Naturw.*, VII, p. 420-425. Leipzig 1916. 1918

Apropos of the ancient legend ascribing to the ostrich the ability to digest iron. It originated in a misunderstood passage of PLINY (lib. X, cap. 1). G. S.

Locy, Will. Albert. The main currents of zoology, VIII+216 p. New York, HOLT, 1918. 1918

A simply written work designed to give elementary students an interest in their scientific forbears. C. S.

Szalay, B. War der Ur wild? *Archiv f. Gesch. d. Naturw.*, VIII, p. 106-123. Leipzig 1917. 1918

Apropos of the often discussed topic : did there exist in Mediaeval Europe two kinds of bison (bison, aurochs) or only one? The zoological evidence points to only one kind : *Bos primigenius*, but the literary evidence is very confused. G. S.

Table of Contents of the First Nine Critical Bibliographies

(Including a Table of Contents of Vol. I, II, III).

This table will enable any one to find rapidly the bibliographical information published in *Isis* about any period of the past. If he be interested in the twelfth century for inst., the table will refer him to the various pages of vol. I, II, III, dealing with S. XII or with the transitional periods S. XI-XII, S. XII-XIII. The reader will keep in mind that this bibliography made for historians is primarily *chronological*, — so is also the table. If he refers to the various pages quoted under other headings, for inst. *China* or *astronomy*, he will find there only the items which could not be included in the fundamental — chronological — classification. Hence if he wishes information on Chinese mathematics in the XIII^th^ century, he should consult the paragraph « S. XIII » as well as the paragraph « China » ; in the same way any paper dealing with an astronomer of the XVII^th^ century, would likely be found under « S. XVII », but it would be well however to read also the paragraph « astronomy ».

It is only in vol. III that the chronological classification has been strictly abided by. In the previous volumes all the information on Greek science for inst. was classified under *Greece*. Hence it is well in each case to consult both the special paragraph and the more general one, for ex. « S. IV A. C. » and « Greece ».

The Editor has tried to improve his system of classification, as himself gained more knowledge and experience. Hence there are some divergences between the classification as used in vol. I and II on one hand, vol. III on the other. Short notes, and when necessary the French titles of the ancient classification, have been inserted in the present Table to protect the reader against misunderstandings.

When a number is underlined, it means that the page bearing this number quotes papers or reviews published in *Isis*. Every one of these indeed is classified in the bibliography. This little device makes it unnecessary to publish a table of contents of *Isis*.

It is hoped that this chronological classification will slowly oblige

historians and scientists to widen their horizon. They will not be able to forget any more that while civilization developed in the Mediterranean basin, synchronous developments of great importance took place in other parts of the world. The most interesting and valuable fruits of historical learning will be obtained some day by a deeper comparative study of Western and Eastern developments, than is now possible. This study is still in its infancy, but we will try to promote it by all means in our power. This classification wherein Latin, Jewish, Islamitic, Chinese, Indian items instead of being grouped apart are mixed and placed in their true chronological sequence is one of these means, and perhaps not the least efficient.

Cambridge, Mass. September 20, 1920. GEORGE SARTON.

PART I. — *Fundamental classification (centurial)*

Before S. IX A. C. — III, 91.
S. IX A. C. — III, 91, 452.
S. VIII A. C. — III, 91, 317.
S. VII A. C.
S. VI A. C. — III, 91.
S. V A. C. — III, 91, 317, *452*.
S. IV A. C. — III, *91-92*, 317-318, *452*.
S. III A. C. — III, 92-93, 318, 452-453.
S. II A. C. — III, 93, 318.
S. I A. C. — III, *93*, 318, 453.
S. I. — III, *94*, 319, 453.
S. II. — III, *94*, 319-320, *453*.
S. III. — III, 95, 320-321.
S. IV. — III, 95, 321, 454.
S. V. — III, 95, 321.
S. VI. — I, 152, 548; III, 95, 321-322.
S. VII. — III, 95, 322, 454.
S. VIII. — I, 152; II, 261, 437-438; III, 96, 322, 454.
S. IX. — II 438; III, 96, 322, 454.
S. X. — I, 152, 762; II, 261, 438; III, 96-97, 454-455.
S. XI. — I, 152; II, 438-439; III, 97, 322-323, *455*.
S. XII. — I, 153, 299, *762*; II, 261, 262, 439; III, 97-98, 323-324, *455*.
S. XIII. — I, 153-154, 299-300, 548-549, *762*; II, 262-263, 439-440; III, *98-99*, 324-327, *455-456*.
S. XIV. — I, 154, 300, 549, *763*; II, 263, 440; III, 99-100, 327-328, 456.
S. XV. — I, 154-156, 300-301, 549-*763-764*; II, 263-265, 440-441; III, *101-104*, 328-331, *456-458*.
S. XVI. — I, 157-159, 301-303, 549-551, *764-765*; II, 265-268, 441-443; III, *104-108*, 331-334, *458-459*.
S. XVII. — I, 159-162, *303-305*, 551-553, *765-767*; II, 268-271, 443-445; III, *108-112*, 334-340, *459-462*.
S. XVIII. — I, 162-168, *305-307*, 553-557, *767-769*; II, 271-278, 445-448; III, *112-115*, 340-343, *462-464*.
S. XIX. — I, 168-172, *308-310*, 557-560, *769-771*; II, 278-282, 448-450; III, *115-120*, 343-347, *465-469* (1).
S. XX. II, 450; III, 120, 347.

Materials for the Biography of Contemporary Scientists and Scholars, (« Nécrologie ») : I, 172-173, *311-312*, 560; III, 120-123.

---

(1) In the ninth critical bibliogr., S. XIX is divided into five sections : A) Mathematics; (B) Physical sciences and Technology; (C) Natural sciences D) Medical sciences; (E) Alia.

Part II. — *Historical classification*

1. *Antiquity*. — I, 544, 758; II, 250-251, 429; III, 347, *469*.

2. *Antiquity, classical*. — I, 144-145, 294-295, 545, 758; II, 253-254, 431; III, 347-348, *470*.

3. *Asia*. (Orient). — I, 151, 548, *761*; II, 435.
   » *Central*. — III, 348.
   » *Eastern*. — I, 151, *761*; II, 259-260, 435.
   » *Western*. — See II, 435 (under « Orient »); III, 470.

4. *Babylonia and Assyria* (Civilisations des caractères cunéiformes, Mésopotamie). — I, 143, 293-294, 544; II, 251, 430; III, 126, 349.

5. *Bible* (*Old Testament*). — III, 126-127, 349.

6. *Byzantium*. — I, 148, 760; II, 433; III, 349.

7. *China*. — I, 151-152, *297-298*, 548, *762*; II, 260-261, 435-437; III, 130-132, 349-350, *470-471*.

8. *Egypt*. — I, 143-144, 294, *758*; II, 252-253, 430-431; III, 91, 133, 350, 471.

9. *Greece*. — I, 145-147, *295-296*, 545-546, *758-760*; II, 254-256, 431-432; III, 135-136, 351, 471.

10. *India*. — I, 149, *297*, 547, *760*; III, 137-139, 351, *471-475*.

11. *Iran*. — I, 151 (under « Orient »); II, 257, 433-434; III, 139-140, 351, 475.

12. *Islam*. — I, 149-151, *297*, 547-548, *760-761*; II, 258-259, 434-435; III, 140, 351-353, *475-479*.

13. *Israël*. — I, 761 (under « Orient »); II, 257-258, 434; III, 140, 353, *479*.

14. *Japan*. — I, 152, 298-299, 548; II, 261, 437; III, 140-141, *479*.

15. *Middle Ages*. — I, 148-149, 296, 546, 760; II, 257, 433; III, 144-145, 353-355, *479-480*.

16. *Rome*. — I, 147-148, 296, 546; II, 256-257, 432; III, 150, 355, 480.

Part III. — *Systematic classification*.

1. *Anatomy, human and comparative*. — (In vol. I and II this was included in « Zoologie, anatomie et physiologie de l'homme et des animaux », for which see Zoology), III, 124, 356.

2. *Anthropology*. — (In vol. I and II this was part of « Anthropologie et Ethnologie; for Ethnology see below), I, 184, *319-320*; 571, *786-787*; II, 302-303, 473-474.

3. *Archaeology, museums and collections*. — I, 186, 321, 572, *787-788*; II, 304-305, 475; III, 124, 356, *481*.

4. *Art. Art and Science. Iconography.* — I, 186, 321-322, 573, *788*; II, 305-306, 476-477; III, 124, 137, 482.

5. *Arts and Crafts.* — III, 124-125.

6. *Astronomy, geodesy, meteorology and terrestrial physics.* — I, 176, 314, 325, 563-564, *776-777*; II, 287-288, 455; III, *125-126*, 357, *482-483*.

7. *Bibliography and libraries.* — II, 305, 475-476; III, 127, *483*.

Biography. — III, 127 (is now a part of 16. History).

8. *Biology.* — I, 178, 315-316, 566, *779-780*; II, 292-293, 459-461; III, *127-129*, 357, *483-484*.

9. *Botany. Agronomy, phytopathology, palaeobotany.* — I, 179, 316, 567, *781*; II, 294, 464-465; III, 129, 357-358, *484-485*.

10. *Chemistry. Physico chemistry. Industrial chemistry.* — I, 177, 314-315, *325*, 565, *778-779*; II, 289-290, 457-458; III, 129-130, 358, *485-486*.

Chronology. — III, 132 (is now a part of 16. History).

11. *Economics. Economic doctrines and history, commerce, transportation, communications.* — III, 132-133, 358-359, 486.

12. *Education. Methods, colleges, universities. History of education.* — (Pédagogie), II, 477-478; III, 359, *486*.

13. *Ethnology. Primitive and Popular science.* — (In vol. I and II, ethnology was part of « Anthropologie et Ethnologie »; but there was another chapter entitled « Les Origines de la Science » subdivided in 3 sections : *a*) Généralités; *b*) Sciences des primitifs; *c*) Science populaire. These materials are now put together under Ethnology), I, 184-185, *319-321*, 571-572, *786-787*; II, 302-304, 473-475; III, 133-134, 359-360, 486-487.

14. *Geography.* — I, 179, 316, *325*, 781; II, 293, 462-463; III, 134-135, 360, 487.

15. *Geology, mineralogy, palaeontology, mining (for palaeobotany and palaeozoology, see botany and zoology).* — I, 179, 567, 781; II, 293-294, 463-464; III, 135, 145, 361, *487*.

16. *History of Civilization. General history, historical methods, biography and chronology.* — I, 186-187, 322, 573, *788-789*; II, 306-307, 478; III, 127, 132, *136-137*, 361, *487-488*.

Iconography. — III, 137 (is now a part of 4 Art, *q. v.*).

17. *Language and Literature.* — II, 477; III, 488.

18. *Logic and Theory of Knowledge.* — I, 561, 774; II, 284, 452; III, 361, *488*.

19. *Mathematics.* — I, 174-176, 313-314, 324, 561-563, *774-775*; II, 284-286, 452-454; III, *141-143*, 362-363, *489-491*.

20. *Mechanics.* — I, 176, 563, *775-776*; II, 286-287, 454-455; III, 146, 364, 491.

21. *Medicine:* A. *History, Organization and Philosophy.* — (Médecine et art vétérinaire), I, 180-182, 316-318, *325*, 568-569, *783*; II, 295-297, 466-467; III, *143-144*, 364-365, *491-492*.

B. *Epidemiology. History and Geography of Diseases.* — I, 182, 569-570, 784; II, 297-298, 467; III, 365.

22. *Morals. History of morals. Moral organization of Society.* — II, 301, 472; III, 145.

23. *Pharmacy and Pharmacology.* — I, 182-183, 318, 570, *784*; II, 298-299, 467-468; III, 145, 365.

24. *Philosophy. Science and Philosophy. History of Philosophy.* — I, 188, *323-324*, 574, *791*; II, 309-310, 480; III, *145-146*, 365, *492*.

25. *Physics.* — I, 177, *314*, 325, 564, *777-778*; II, 288-289, 456-457; III, 146-147, 365-366, *492*.

26. *Physiology.* — (In vol. I and II, this was included in « Zoologie, anatomie et physiologie de l'homme et des animaux » for which see Zoology) III, 148, 366, 492-493.

27. *Prehistory.* — I, 183-184, 319, 571, *786*; II, 302, 472-473; III, *148-149*, 366, 493.

28. *Psychology.* — (Psychologie et Psychiatrie), I, 183, 318, 570, 784-785; II, 299-300, 468; III, *149*, 367.

29. *Religion. Science and Religion. History of Religions.* — I, 187, *323*, *789-790*; II, 308, 479-480; III, 149-150, 367, 493.

30. *Science* : (In vol. I and II, two chapters were entitled: the first one « Méthodologie. But et signification des recherches historiques », for this, see now « Science, B. »; the second one, « Généralités relatives à l'histoire et à l'organisation de la science ». The materials of this second chapter are now placed partly under Science B, and partly under Science C. For this second chapter see, I, 174, *312-313*, *324*, 560-561, *772-773*; II, 283, 450-451).

A. *Bibliography.* — III, 150.

B. *History.* — I, 173-174, 189-190, *312*, 325-326, *772*; II, 283, 450; III, *150-152*, 367-368 *493-495*.

C. *Organization.* — III, *152*, 368, *495-496*.

D. *Philosophy.* — III, 152-153, 368-369.

31. *Sociology, jurisprudence and positive polity.* — I, 570-571, 785; II, 301, 468-472.

32. *Statistics.* — II, 286, 454; III, 369, 496.

33. *Superstition and Occultism.* — (Science et Occultisme, histoire des sciences occultes, histoire de la sorcellerie), I, 187, 322, 574, *789*; II, 307, 478-479, *496*.

34. *Technology* — (For mining see geology; for industrial chemistry, chemistry. See also arts and crafts). I, 177-178, *315*, 565, *779*; II, 290-291, 458-459; III, 153, 369-371, *496-497*.

35. *Zoology*. — (In vol. I and II, « Zoologie, anatomie et physiologie de l'homme et des animaux ». This material is not classified under three different heads : Zoology; Anatomy. Physiology; *q. v.*), I, 179-180, 316, 568, *782-783*; II, 294-295, 465. — Zoology alone, III, 153-154, 371, 497.

36. *Alia*.

ERRATA

(*See also* II, 480; III, 155)

TOME III. — P. 88, l. 24, read : cliniques (not chimiques).
99, last §. **Hamdallah**.
101, l. 13, RĀMĀNANDA.
132, l. 10, Sung instead of Such.
168, l. 15, read : biographical, chiefly.
170, l. 13, no comma.
323, l. 2, 3 read bell instead of clock.
325, last line of LIPPMANN note, read lines instead of livres,
328, l. 11, read contagious.
329, l. 24, read ἀκὰθαρτα.

Index of Authors To Vol. II + III

A

Abbadie, A. (d'), III, 468.
Abbeville, C. (d'), III, 371.
Abd al Kadir b. Ali b Sàban, al Sufi. *Muhji ad-din*, III, 456.
Abd Al Rahman, *Al Sufi*, II, 401, 413 sq.
Abderrazaq, *el Djezaïry*, II, 258.
Abdus Salam, III, 217.
Abels, A., II, 298.
Abenbéder, III, 97.
Abhari, Al., III, 456.
Abraham, H., II, 156.
Abraham, J. J., III, 102.
Accorso, III, 324.
Achard, F. K., III, 342.
Acosta, C., II, 418.
Ackermann, A. S. E., III, 115.
Ackermann, J. F., III, 483.
Acqua, Camilla, II, 464.
Açvaghosa, III, 76.
Adam, C., II, 37, 41, 44, 48, 50, 53, 54, 58, 66, 74, 80, 82; III, 35, 47, 50-53, 55-58.
Adams, E. D., II, 480.
Adams, J. C., III, 291.
Adelard, *of Bath*, III, 263, 269.
Adler, A., II, 468.
Aepinus, II, 456.
Aesculapius, III, 355.
Aetius, III, 348.
Afçusi, P. (Alphonsi), III, 398.
Africanos, III, 304.
Agassiz, A., II, 281.
Agassiz, Elizabeth C., III, 347.
Agassiz, G. R., II, 281.
Agassiz L., II, 365 sq.
Agathodaemon, III, 303, 422.
Ageorges, J., II, 448.
Aggiunti, N., II, 268; III, 110.
Agnew, P. G., II, 285.
Agrate, M. (d'), II, 266.
Agrippa, Cornelius, II, 68.
Aguilera, J. G., II, 377.
Ahmad ibn Yahya, *al Baladuri*, III, 140.
Ahrens, W., II, 257; III, 334, 459, 475.
Aida Ammei, II, 29, 437.
Aillet, G., II, 470.
Ailly, P. (d'), II, 263; III, 281.
Airy, *Sir* G. B., III, 291, 417.
Airy, W., III, 469, 475.
Ajima Chokuyen, II, 412.
Akbar, III, 204.
Ala, abu'l, II, 258; III, 97.
Alain *de Lille*, II, 75; III, 42.
Albert *of Cologne*, III, 298.
Albertus Magnus, II, 49, 68, 262; III, 145, 325.
Albiruni, II, 259, 349 sq., 356, 435; III, 217.
Albrecht, II, 192, 472; III, 439,

Alcmeon, II, 67.
Alderotti, T., III, 325.
Aldovrandi, U., II, 442; III, 332.
Alembert, (d'), II, 424.
Alexander, *Aphrodisaeus*, II, 207; III, 278.
Alexander *the Great*, III, 208, 209.
Alexander, P. F., III, 104.
Alexander *of Tralles*, III, 436.
Alfredus *Anglicus, of Sareschel*, II, 49, 439.
Alhabib, III, 305.
Ali bin Muhammad Kushji, II, 413.
Ali ibn Ahmad al-Sharafi di Sfax, III, 459.
Ali ibn al-Abbas (Haly Abbas), II, 258.
Ali Ibn al-Magribi, A. H., III, 456.
Allbutt, *Sir* T. C., II, 433; III, 61, 123.
Allen, III, 484.
Allen, H. S., II, 288.
Allen, P. S., II, 264; III, 104, 105.
Allendy, R., III, 25.
Alline, H., III, 92.
Amaduzzi, L., III, 491.
Amagat, E. H., III, 120.
Almagia, R., II, 173; III, 360, 456, 458.
Amar, J., II, 465.
Almasof, A. T., III, 329.
Ames, J. S., III, 491.
Amirdolrathe *of Amazia*, III, 329.
Amodeo, F., III, 41.
Ampère, A. M., II, 223, 277, 397, 424, 427, 456; III, 465.
Andel, M. A. (von), II, 264.
Andernach, G. (de), II, 64.
Andersen, D., III, 184.
Anderson, J., III, 202.
Andoyer, H., II, 285.
Andrea, J. V., III, 108.
Anesaki, Masaharu, III, 98, 140.
Angelus, Johannes, III, 321.
Anthiaume, A., III, 134.
Anthony, R., III, 122.
Apastamba, II, 328, sqq.
Apelli, Paul, II, 453.
Apinus, J. L., III, 45.
Apollinaire, G., II, 103.
Apollonius, *Pergaeus*, III, 93.
Apollonius *of Tyana*, III, 319.
Appell, P., II, 453; III, 417.
Appert, *Dr*, III, 295, 484.
Apte, V. S., III, 178.
Apuleius, III, 94.
Aragos, G., III, 26.
Aransi, II, 87 sq.
Arber, Agnes, II, 208, 415-418.
Archibald, R. C., III, 92, 93, 334, 344, 362, 465, 471, 489, 491.
Archibald, R. G., III, 341.
Archimedes, II, 254, 255, 355; III, 92, 93.
Arcœus, F., II, 68.
Ardern, John, II, 263; III, 309, 329.
Arendt, F., III, 93.
Argand, A., III, 342.
Argentier, G., II, 55.
Argentier, J., II, 68, 77; III, 36, 43.
Ariès, E., II, 289, 457.
Arima Raido, II, 17, 20, 23.
Aristarchus, *of Samos*, II, 255.
Aristippus, Henricus, III, 278.
Aristophanes, II, 255.
Aristos, III, 434.
Aristotle, II, 49, 55, 67, 69, 72, 105, 164, 202 sq., 204, 207, 228, 229, 255, 256, 262, 451; III, 7,

8, 12 sqq., 42, 45, 91, 92, 152, 278 sq., 305, 312, 318, 353, 371, 432, 440, 452, 489.
Aristoxenes, III, 318.
Armstrong, H. E., III, 61.
Armstrong, R. C., III, 140.
Arnaus, III, 37.
Arne, T. J., III, 96.
Arnobe, II, 271.
Arnold, E. V., III, 480.
Arnold, T. W., II, 258.
Arny, H. V., III, 147.
Arréat, L., III, 73.
Arrhenius, Svante, II, 455; III, 125.
Arrian, Flavius, III, 208, 209.
Arthus, M., II, 295.
Arun Sen, III, 103.
Aryabhata, II, 333 sqq., 356.
Asanga, III, 194, 213.
Aschepiades *of Prusa*, II, 88; III, 43, 348.
Aselli, G., II, 44, 55; III, 28.
Ashley, T. W., III, 328.
Ashmole, E., III, 110.
Asoka, III, 204, 452.
Assagioli, R., II, 300.
Assier de la Tour, A. (d'), II, 448.
Astruc, J., III, 342.
Athalye, III, 73, 192, 242, 248, 252, 253.
Athenæus, III, 112.
Athir, ibn al, III, 352, 353.
Atkinson, C. M., II, 447.
Auber, II, 64.
Aubry, A., II, 107.
Aubry, E., II, 299.
Aubry, J. (d'), III, 26.
Audry, N., II, 65.
Aufidius Siculus, T., III, 319.
Aufrecht, T., III, 176, 177, 189.
Augustine, *Saint*, II, 69, 256.
Aung, Shwe Zan, III, 137.
Auric, A., III, 357.
Ausonius, Decinus Magnus, III, 95, 321.
Autenrieth, J. H. F., III, 483.
Avalon, A., III, 77-81, 197, 471, 472.
Avalon, Ellen, III, 78, 471.
Avalon, J., II, 146.
Avelot, R., II, 293, 307.
Avenarius, II, 309; III, 369.
Averdunk, H., III, 105.
Averroes, *ibn Ruscha*, II, 258, 434; III, 264.
Avicenna, II, 67, 434.
Avogadro, A., II, 169, 195, 277; III, 427.
Awam, ibn al, III, 352.
Aymonier, E., III, 215.
Azraqui, el, II, 258.
Azyr, V. (d'), II, 214, 447; III, 28.

B

Baas, K., II, 257, 265; III, 359.
Babbage, C., III, 291.
Babcock, W. H., II, 462.
Babinger, F., II, 268.
Babur, III, 108, 204.
Bachelier, L., II, 452.
Backhouse, E., II, 260.
Bacon, Francis, II, 42, 53, 85, 228, 230, 268, 442; III, 26, 55, 112, 324.
Bacon, Roger, II, 164, 203, 207, 439; III, 98, 99, 145, 280-282, 324-326.
Bacot, J., III, 215.
Bâdarâyana, II, 407; III, 473.
Baeck, A., II, 273.

Baedeker, K., II, 401 sq.; III, 472.
Baekeland, L. H., III, 115.
Baer, C. E. (von), II, 460.
Baer, J., II, 257, 265, 305, 463; III, 487.
Baerlein, H., II, 258; III, 97.
Baeumker, C., II, 262, 439; III, 325.
Baeyer, *Général*, II, 191 sq.
Baeyer, J. J., III, 439.
Baglioni, S., III, 334.
Baglivi, II, 64; III, 30, 35.
Bailby, Dr, II, 254.
Bailey, P., III, 37, 112.
Baillarger, II, 299.
Baillaud, B., II, 190, 192, 396.
Baillet, A., II, 45, 54, 55, 73; III, 30.
Baillet, J., II, 252.
Baily, F., II, 414; III, 284.
Bain, A. G., II, 373.
Bainbridge, J., II, 414.
Baines, III, 111.
Baines, A., III, 204.
Baird, S. F., III, 116.
Bairstrow, L., III, 61.
Baker, Annie L., III, 117.
Baker, H., II, 212; III, 115.
Bakewell, C. M., III, 16, 17.
Bakhuysen, H. G. Van de Sande, II, 192.
Balch, T. W., II, 418-420, III, 460.
Baldacci, A., II, 442; III, 330.
Baldensperger, P. J. F., II, 477.
Baldi, B., III, 51, 334.
Ball, C. J., II, 250.
Ball, W. W. R., III, 141.
Balland, A., II, 275.
Ballantyne, J. R., III, 191, 192.
Bana, III, 95.
Banerjea, K. M., III, 196.
Ban Seiyei, II, 29.
Bapu deva Sastri, II, 355.
Barach, C. S., II, 49.
Baratta, M., III, 457, 458.
Barber, H. L., III, 153, 369.
Barbey-Boissier, Mme C., II, 310.
Barbier, A., II, 42.
Barbour, A. H. F., II, 256.
Barca, H., II, 442.
Barduzzi, D., II, 154, 263, 439, 442, 450; III, 99, 331, 355.
Barentin de Monchal (Mme de), II 446.
Baring, M., II, 462.
Barker, E., III, 135.
Barnard, F. P., III, 141.
Barnd, J., II, 470.
Barnes, H., III, 355.
Barnett, Lionel D., II, 408-410; III, 196, 472.
Barnhardt, J. H., III, 115.
Barnich, G., III, 115.
Barodia, U., III, 195.
Baroncini, R., III, 334.
Barozzi, F., III, 332.
Barrell, J., III, 116.
Barrett, W. F., II, 299.
Barrow, I., III, 109, 283, 336, 460.
Barry, III, 31.
Bartels, M., II, 303.
Barth, A., III, 65 sq., 76, 172, 186, 196, 472.
Barth, H., II, 443.
Barthélemy Saint-Hilaire, J., III, 45.
Barthet, III, 118.
Barthez, P. J., II, 50; III, 27, 45.
Barthold, W., III, 176.
Bartholin, III, 445.
Bartholin, Casparus, the elder, II, 44, 62, 71-73, 75, 77; III, 46,

Bartholin, Casparus, the younger, II, 87.
Bartholin, Thomas, II, 44, 50, 52, 56, 64, 71.
Bartholomae, C., III, 181.
Bartholomaeus *Anglicus* (de Glanvil), II, 262; III, 263.
Bartholomew, J. G., III, 136.
Bartisch, G., III, 332.
Bartlett, W. P. G., III, 417.
Barton, G. A., III, 126.
Bartram, W., II, 465.
Bartsch, P., III, 153.
Bartscherer, A., II, 47.
Bary, P., II, 308.
Basedow, II, 399.
Barmadjan, K. J., III, 470.
Bassols, J. (de), III, 39.
Bassus, Cassianus, *Scholasticus*, III, 352.
Bastian, A., II, 199.
Bastian, C., II, 461.
Bastide, C., III, 361.
Baston, A., III, 199.
Bateson, W., II, 200, 230 sq.; III, 61, 128.
Bathurst, R., II, 61.
Battani, el., II, 354.
Batuta, ibn, III, 217.
Baudhayana, II, 328 sqq.
Baudouin, M., II, 250, 304, 472-474; III, 366.
Bauer, E., II, 197.
Bauer, H., II, 294.
Bauernfeind, III, 466.
Bauhin, G., II, 43, 64; III, 24.
Bauhin, J., III, 107.
Baumé, III, 445.
Baumgartner, A., III, 197, 201.
Bavink, G., III, 122.
Bayle, A. L. J., II, 299.
Bayle, P., II, 81, 83-85; III, 12.
Bayley, E. C., II, 356.
Bayliss, W. M., III, 148.
Beal, S., III, 214.
Beale, O. C., II, 469.
Beames, J., III, 185.
Beattie, J., III, 289.
Beaumont, E. (de), II, 365, 372, 377.
Bechterew, V., II, 299, 303, 468.
Beck, H., III, 210.
Beck, L., II, 92, 93.
Becker, A., III, 105, 462.
Becker, C. H., III, 352.
Becquerel, P., II, 459.
Beddevole, Dominique, III, 22 sq.
Bede. *The Venerable*, III, 454.
Beer, R., II, 428.
Beguinot, A., III, 60.
Behr-Pinnow (von), II, 282.
Beithar, ibn el, II, 258.
Beke, E., II, 453.
Bekker, B., III, 54.
Bekker, I., III, 278.
Belin, J. P., II, 271.
Bell, *Sir* C., II, 276.
Bell, E., III, 133.
Bell, H. I., II, 262.
Bellet, D., II, 469.
Bellini, II, 60; III, 27, 29, 30, 45.
Belloni-Filippi, F., III, 190.
Bellot, T., III, 320.
Belot, E., III, 496.
Beltrami, L., III, 101, 103, 330, 331, 457.
Bénazet, A., II, 198.
Bendall, C., III, 177.
Benedetti, A., III, 457.
Benedetti, G., III, 334.
Benedetto, A., III, 38, 102.
Benedict, H. Y., III, 363.
Benedict, Susan R., III, 141, 413.

Beneke, R., II, 446.
Benfey, T., III, 183, 187, 200.
Benini, M., II, 167.
Benisch-Darlang, Eugénie, II, 275.
Benjamin, M., III, 115.
Benoit, F., II, 476; III, 207.
Benrath, A., III, 115.
Bensaude, J., III, 424, 426, 457.
Bentham, J., II, 447.
Bentley, R., III, 288 sq.
Benu Musa, III, 353, 478.
Berachya, III, 269.
Bérenger *de Carpi*, II, 45, 56, 61, 69; III, 38.
Bergaigne, A., III, 182, 183, 187, 199.
Bergell, P., II, 275.
Berger, H., II, 201; III, 144.
Berget, A., II, 455.
Bergey, D. H., III, 115.
Bergman, T. O., III, 333.
Bergmann, E., 445.
Bergmann, H., II, 285.
Bergounioux, J., II, 275.
Bergson, H., II, 102, 105, 310; III, 311 sq., 468.
Bergstræsser, G., II, 240; III, 351.
Berkeley, G., II, 70; III, 113, 289, 290, 341, 363, 463.
Bernard, A., II, 278.
Bernard C., II, 65, 67, 76, 79, 164, 278, 449; III, 49, 50, 119.
Bernard J. S., II, 49.
Bernard, L. L., II, 300.
Bernard, Sylvestris, III, 268.
Bernier, F., III, 109.
Bernouilli, D., II, 62, 270; III, 33.
Bernouilli, Jacques, II, 395; III, 462.
Bernouilli, Jean, II, 111, 115, 122, 444; III, 33, 438.
Berr, H., III, 361.
Berthelot, M. P. E., II, 61, 103, 259, 322, 424; III, 206, 303, 431, 442, 494.
Berthold, G., II, 271; III, 346, 459.
Berthollet, C. L., II, 169.
Berthoud, A., II, 457.
Bertrand (*of Marseille*), II, 65.
Bertrand, A., II, 40, 83; III, 29.
Bertrand, J., II, 424; III, 418, 468.
Bertrand, L., III, 116.
Bertrand, M., II, 368, 388 sq., 391.
Berzélius, J., II, 169, 275; III, 427, 442.
Beschorner, H., II, 293, 462.
Bessel, II, 275; III, 438, 439.
Betti, II, 181.
Beutel, E., II, 284.
Beveridge, H., III, 218.
Bezold, C., II, 251; III, 482.
Bezzenberger, A., III, 176, 182.
Bhandarkar, *Sir* R. G., III, 76 sq., 176, 185, 196, 472.
Bhasa, III, 199.
Bhaskara, II, 335 sqq., 356.
Bhisragratna Kavihaj Kunja Lal, III, 472.
Bhoja, III, 191.
Bianchi, G., II, 213; III, 114, 341.
Bichat, M. F. X., II, 79, 228.
Bicknell, C., II, 473.
Bidez, J., II, 433.
Biechele, J., III, 114.
Bienvenu, *Dr*, II, 272.
Biesbroeck, G. (van), II, 270.
Bigandet, P., III, 215.
Bignami, A., II, 213.
Bignone, E., III, 317.
Bigot, A., II, 463.
Bigourdan, G., II, 287; III, 125, 126, 133, 334, 335.

Bilancioni, G., II, 57, 210, 213, 265, 445; III, 34, 55, 114, 330, 340.
Biler, J. M., III, 340.
Bilharz, T., III, 467.
Billings, J. S., III, 120.
Bindoni, G., III, 325.
Binyon, L., III, 124.
Binz, G., II, 399, 400.
Biondo, III, 38.
Birringuccio Vannoccio, II, 90-99, 265, 458; III, 60, 106.
Birkhoff, G. D., III, 343.
Birkner, F., II, 273 sq.; III, 133.
Bischoff, I., II, 281.
Bittard, A. L., II, 308.
Biruni, al., III, 477.
Björnbo, A. A., II, 205 sq.
Black, G. F., II, 473.
Black, J., II, 168.
Blagden, C., III, 215.
Blainville, III, 22.
Blanc, A., II, 197.
Blancard, E., II, 59.
Blanchard, R., II, 445.
Bland, J. O. P., II, 260.
Blankaart, E., III, 23, 29.
Blaringhem, L., III, 295, 484.
Blegny, N. (de), II, 70, 79; III, 22, 26.
Bloch, B., II, 87.
Bloch, Ernst, II, 62, 168, 423 sq., 495.
Bloch, Eugène, II, 197.
Bloch, G., II, 256.
Bloch, J., III, 186.
Bloch, L., III, 57.
Bloch, M. E., II, 273.
Blochet, E., III, 217.
Block, W., II, 282.
Blok, P. J., III, 127.
Blomstrand, III, 442.
Blondel, C., II, 447.
Blondel, F., II, 268, 297.
Bloomfield, M., III, 188.
Blumenbach, III, 440.
Bobart, Jacob, *the elder*, II, 271; III, 340.
Bobart, Jacob, *the younger*, II, 271.
Bobynin, V., II, 136, 137.
Boccaccio, III, 100.
Bode, Mabel, III, 215.
Bodeman, III, 32.
Bodin, J., II, 267, 420.
Bodin, L., II, 305.
Boerhaave, II, 60, 65, 78; III, 25 sq., 31 sq., 45, 343.
Boersch, O., II, 193.
Boetticher, J. F., III, 28.
Boggio, *Prof.*, II, 182.
Bohn, G., II, 84.
Bohn, J., II, 79.
Bohnenberger, III, 438.
Böhtlingk, O., III, 183, 184, 190, 201.
Boinet, III, 22, 24, 45, 48.
Boirac, E., II, 309.
Boll, F., II, 251; III, 482.
Bölsche, W., II, 449.
Boltzmann, II, 194.
Bolyai, J., II, 280; III, 343.
Bolyai, W., II, 280.
Bolzano, B., II, 447; III, 120.
Bombe, H., III, 465.
Boncompagni, B., II, 133 sq.; III, 324, 367, 396.
Bonet, J., II, 78.
Bonet-Maury, J., II, 308.
Bonitz, H., III, 42.
Bonnard, L., II, 256.
Bonnet, A., II, 292.
Bonnet, C., II, 82, 83, 87, 228; III, 440.

Bonnet, E., II, 443, 448.
Bonney, T. G., III, 61.
Bontekoë, Cornelis, II, 71, 78; III, 29.
Boole, G., III, 116, 291, 312.
Bopp, F., III, 181, 183.
Bord, B., II, 150.
Bordas-Demoulin, J.-B., II, 69, 74, 80, 81; III, 29.
Bordeu, II, 77, 79; III, 22, 45, 47 sq.
Borel, E., II, 197 sq., 285, 289; III, 417.
Borelli, G. A., II, 51, 60, 62, 64, 72, 78, 228, 442; III, 27-31, 33-35.
Borgia, C., III, 103.
Bortkiewicz, L. (von), II, 289.
Bortolotti, E., II, 284, 453; III, 362.
Boruttau, H., II, 265.
Bosch, F., II, 460.
Bose, Nanda Lal, III, 117.
Boshcovic, R. J., III, 367.
Bosmans, H., II, 267, 268; III, 282.
Bossert, G., II, 266.
Bossu, L., II, 263.
Bossuet, II, 50, 62, 75, 86; III, 28.
Boström, II, 273.
Botsford, G. W., III, 135.
Bottazzi, F., III, 37, 330.
Böttiger, II, 143.
Bouchard, C., II, 466.
Boucheny, G., III, 120, 121, 122.
Boucher, III, 30.
Bouchier, E. S., II, 432.
Boué, A., II, 381.
Bougeant, *le Père*, II, 83; III, 50.
Bougerel, II, 45, 54, 55, 83.
Bouglé, C., III, 204.
Bouillaud, J., III., 55.
Bouillier, F., II, 76, 81, 83; III, 22, 30, 32, 43, 45, 46.
Bouillier, V., II, 445.
Boulangé, C., II, 150.
Boulanger, A., III, 116.
Boulanger, N. A., II, 303, 473.
Boullay, III, 427.
Bourdelot, II, 70.
Bourdin, A., II, 72.
Bourdon, L. P. M., III, 416.
Bourgeois, II, 192.
Bourgeois, Léon, II, 199.
Bourgois, L., II, 261.
Bourguet, III, 445.
Bourneville, II, 467.
Boussinesq, II, 181.
Boussingault, II, 279.
Boutroux, E., II, 80, 81; III, 52, 306, 488.
Boutroux, L., III, 317.
Boutroux, P., II, 309, 443; III, 57.
Bovet, P., II, 105.
Bowditch, C. P., III, 293.
Bowie, W., II, 455.
Bowne, B. P., III, 12.
Bowser, E. A., III, 416.
Boyd, C. E., III, 150.
Boyle, R., II, 57; III, 22, 26, 111.
Bozorg, III, 217.
Braams, W., III, 347.
Brachet, A., II, 168; III, 116.
Bradley, F. H., III, 311.
Bragg, W. H., III, 61.
Brahe, Tycho, III, 105, 458.
Brahmagupta, II, 335 sqq., 356.
Braikenridge, W., III, 290.
Bramante, III, 102.
Brander, G. F., III, 464.
Brandes, G., II, 448.
Brandis, J. D., III, 483.

Branford, R., II, 453.
Branner, J. C., III, 361.
Brasch, F. E., III, 112, 151.
Bratti, III, 26.
Brande, L., II, 453.
Braun, M., II, 142.
Braune, W., III, 454.
Braunmühl (von), II, 356.
Bréal, M., III, 181.
Breasted, J. H., II, 252.
Brehaut, E., III, 95.
Bréhier, E., II, 254.
Bréhier, L., III, 95, 96.
Breitenbach, W., II, 281.
Bremer, H. E., III, 370.
Bremiker, III, 439.
Bresgen, M., II, 281.
Breteille, R. C., II, 295.
Bretschneider, H., II, 143; III, 299.
Breuer, P., II, 398.
Breuil, H., II, 237.
Brewer, II, 164.
Brewster, *Sir* D., III, 285.
Brieger, W., III, 318, 335.
Brière, G., II, 476.
Briggs, H., III, 339.
Briggs, J., III, 217.
Briggs, W., III, 31.
Bright, R., III, 345.
Brill, A. A., II, 468; III, 104.
Brill, E. J., II, 258, 259.
Brini, J. T., II, 79.
Brinkley, F., III, 140.
Brinner, L., II, 293.
Brinton, D. G., III, 292.
Broca, II, 199.
Brocard, H., II, 106, 120.
Brochard, V., III, 12.
Brock, A. J., III, 320.
Brock, *Sir* T., II, 166.
Brockwell, M. W., III, 105.
Brocquet, *D^r*, III, 98.
Brockhuysen, B., III, 23, 29.
Brofferio, A., III, 190.
Broglie (de), II, 193; III, 147.
Broili, F., II, 293.
Brongniart, A., II, 362, 371.
Bronson, W. C., III, 359.
Brooks, A. A., III, 134.
Brooks, E. C., III, 357.
Brose, H. L., III, 364.
Brosses, C (de), II, 198, 302, 473.
Brown, J., III, 335.
Brown, P., III, 202, 207, 208.
Brown, R., II, 289.
Brown, T., III, 335.
Brown-Séquard, III, 117.
Browne, E. G., III, 149, 467, 475.
Browne, F. F., II, 448.
Browne, G. F., III, 454.
Brownne, J. S., II, 148.
Bruce, W. C., III, 112.
Brücker, J. J., III, 12, 30.
Brückner, G., II, 278.
Brugmann, K., III, 179, 181, 182.
Brugnoli, B., II, 439.
Brulart de Saint-Martin, P. (de), III, 338.
Brunet, L., III, 270.
Brunhes, J., II, 462.
Brunner, II, 71.
Brunner, K., III, 459.
Brunnhofer, H., III, 199.
Bruno, F. (de), III, 417.
Brunschvicg, L., II, 80, 443; III, 57, 277.
Brunschwygh, H., III, 102.
Bruylants, P., II, 457.
Bryan, G. H., III, 121.
Bryce, *Viscount*, II, 435.
Bubnov, III, 397, 398.
Buch, A., II, 295.
Buch, L. (von), II, 364-366, 371.

Buch, M., II, 295.
Buchard, *admiral*, III, 134.
Buchheim, E., III, 348.
Buchholz, III, 439.
Buchka, K. (von), II, 154, 267.
Büchner, L., III, 484.
Buchwald, G., II, 440.
Buck, A. H., III, 143, 462.
Buckler, W. H., III, 351.
Budde, E., II, 285.
Buddha, III, 193-195, 200, 209, 215, 472, 473.
Budge, A. E. W., II, 430, 435, 454.
Buffenoir, H., II, 272.
Buffier, III, 29.
Buffon, II, 79, 209-213, 228, 229, 273, 358, 424; III, 113, 440, 445.
Bühler, G ,II, 356; III, 178, 180, 183, 195, 197, 203.
Bührer, K. W., II, 128.
Bungay, Thomas, III, 281.
Bunyiu Nanjio, III, 213.
Buonafede, A., III, 30.
Burali-Forti, C., II, 173, 174-182; III, 143.
Burch, G. J., III, 120.
Burckhardt, A., II, 441.
Burg, C. L. (van der), II, 146.
Burgess, E., II, 355.
Burgess, J., III, 180, 195, 202, 206, 207, 218.
Bürgi, J., III, 286, 339.
Burgstaller, S., II, 288.
Bürk, A., II, 355; III, 250.
Burley, W., III, 41.
Burne, Charlotte S., III, 133.
Bürner, G., II, 254.
Burnet, E., III, 361.
Burnet, J., III, 9, 135.
Burnouf, E., III, 184, 193, 196.
Burns, III, 343.
Burns, C. Delisle, III, 98, 111, 136, 335.
Burns, Josephine E., II, 285.
Burns, R., III, 342.
Burr, A. H., II, 57.
Burr, Anna R., II, 479.
Burr, C. W., III, 149.
Burr, G. L., III, 109, 274.
Buschan, G., II, 303; III, 133.
Bussey, W. H., III, 460, 465, 489.
Butavand, F., II, 456.
Butini, J. A., III, 34.
Butler, H. E., III, 94, 449, 496.
Butler, N. M., II, 469.
Butler, Samuel, II, 281.
Buttar, C., II, 300.
Bützberger, F., II, 284.
Buxton, H., II, 435.
Buxton, L. H. D., II, 302.
Buxton, N., II, 435.
Buzello, H., III, 122.
Byerly, W. E., III, 416.
Byrhtferd, III, 97.
Byse, C., II, 272.

C

Cabanès, *Dr*, II, 146, 268; III, 143.
Cabanis, G., II, 217, 277, 447.
Cabaton, A., III, 176, 215.
Cabral, P., III, 101.
Cælius Aurelianus, III, 43, 319, 321, 348, 355.
Caetani, L., II, 434.
Cagnat, R., III, 150.
Cahen, A., III, 482.
Cajori, F., II, 257; III, 7-10, 92, 105, 109, 111, 116, 133, 141, 282 sq., 335, 336, 362, 414-418, 452, 460, 463, 465, 489.

Caland, W., III, 188.
Caldani, L. M. A., III, 341.
Calder, W. M., III, 453.
Calderoni, M., II, 246.
Caldwell, R., III, 186.
Calhoun, J. W., III, 363.
Callet, A., II, 57.
Callot, J., II, 443.
Calmette, F., III, 26.
Calvert, P. P., III, 467.
Camerarius, E., III, 45.
Cametti, A., III, 60.
Camões, III, 425.
Campa, O., II, 276.
Campanella, T., II, 85.
Campbell, II, 264.
Campbell, N. R., II, 283, 456.
Campbell, W. J., III, 112.
Camper, P., II, 71, 272.
Camus, J., II, 278.
Candolle, A. (de), III, 299.
Candolle, C. (de), 310.
Candolle, *M^me^* C. (de), II, 275.
Canepa, A., III, 457.
Çankara, II, 407 sq.; III, 193, 238, 473.
Cannan, E., II, 469.
Cannani, J. B., II, 56.
Cannizzaro, S., II, 195; III, 367.
Cantor, G., III, 15, 311-313, 343.
Cantor, M., II, 134 sq., 136, 157, 356; III, 82, 277, 285, 397, 477.
Cany, G., II, 270.
Capart, J., II, 430.
Capelli, A., II, 137.
Capitan, L., II, 478.
Capparoni, P., II, 256, 304, 441, 444; III, 331, 336.
Cappeller, C., III, 184, 199.
Capper, J. B., II, 168; III, 123.
Carbonelli, A., II, 298.
Carbonelli, G., II, 466.
Carcano, II, 45.
Cardano, G., II, 49, 68; III, 38, 131, 434 sq.
Cardan, J., see Cardano, G.
Careil, (Foucher) de, II, 84.
Carloni, F., II, 295.
Carlyle, A. J., III, 144.
Carlyle, R. W., III, 144.
Carmichael, R., III, 415, 489, 491.
Carnegie, A., III, 347.
Carnot, III, 466.
Carnot, H., II, 199.
Carnot, L., III, 116.
Carnot, L. N. M. (de), II, 282.
Carosio, M., III, 105.
Carpenter, H. C. H., III, 61.
Carr, H. W., II, 310.
Carra de Vaux, B., III, 57, 141, 434 sq., 476, 489, 490.
Carrington, H., II, 307.
Carslaw, H. S., III, 336
Cartailhac, E., II, 302.
Carus, P., II, 260, 281, 432, 435, 447, 449; III, 73-76, 324, 472.
Carvallo, E., III, 417.
Case, S. J., III, 94.
Casmann, *Rektor*, III, 106.
Caso, A., II, 171; III, 152.
Casserius, J., II, 64, 69.
Cassini III, II, 396.
Cassirer, E., II, 284.
Cassuto, L., II, 290.
Castel, L., II, 275.
Castelli, B., III, 461, 493.
Castle, Cora, S., II, 301.
Castro, M. F. (de), II, 377.
Catelan, *D^r^*, II, 276.
Catherine *of Siena, Saint*, III, 99.
Cato *Censorius*, III, 318.
Caton, R., III, 351.
Cattell, J. M., II, 283, 301.

Cauchy, II, 181.
Caudel, M., II, 472.
Caullery, M., II, 232, 460; III, 120.
Cavalieri, III, 461.
Cavendish, H., II, 168.
Caverni, R., III, 367, 461, 493 sq.
Cayley, A., III, 291, 417.
Cecco d'Ascoli, III, 145.
Celaya, J. (de), III, 41.
Cellini, Benvenuto, III, 333.
Celoria, G., II, 276.
Celsius, A., III, 341.
Celsus, Aurelius Cornelius, II, 257; III, 319, 348.
Cerruti, II, 181.
Cervetto, G., III, 367.
Cesalpino, A., II, 54, 57, 67, 87, 228, 267; III, 102.
Cestre, C., III, 361.
Chafagi, III, 353.
Chaignet, A. E., II, 49.
Chakrapani, II, 324.
Chalcidius, III, 267, 268.
Chalmers, A. J., III, 341.
Chambertin, T. C., II, 394.
Champault, P., II, 278.
Chandhuri, T. C., III, 122.
Chang-Ch'in-chien, II, 352.
Chang Chung-King, III, 301.
Chang Ki, III, 301.
Chang K'ien, III, 301.
Chang T'sang, II, 351.
Chao, Yuen Ren, III, 130.
Chaplin, A., II, 276; III, 346.
Chapot, V., II, 431, 475; III, 135, 150.
Chappelier, A., II, 268.
Charcot, *D^r*, II, 293.
Charleton, G., II, 50, 60.
Charpentier, J. F. W., II, 370.
Chase, P. E., III, 417.
Chasles, II, 122.
Chatterji, J. C., III, 178, 192.
Chaucer, III, 100.
Chauffard, A., II, 199.
Chauffour, H., II, 288.
Chau-Ju-Kua, II, 260, 436.
Chauliac, G. (de), II, 56, 67, 68, 73, 75, 263; III, 329.
Chautard, J., II, 464.
Chauveau, L., II, 281.
Chauvenet, W., III, 417.
Chauvet, II, 67, 73, 74, 88; III, 42, 43.
Chavannes, E. E., II, 260, 435; III, 96, 98, 120, 130, 201, 213, 214.
Chavannes, P. (de), II, 449.
Chavant, *D^r*, II, 295.
Chavez, E., II, 170 sq.; III, 152.
Checchia, N., II, 309.
Cheïkho, III, 435.
Cheinisse, L., II, 57.
Cheresheff, B., II, 377.
Cheyne, G., III, 31, 45.
Cheyne, *Sir* W., II, 166.
Chézy, A., III, 198.
Chih-San Chen, II, 437.
Child, J. M., III, 109-111, 116, 254-261, 283, 336, 337, 460, 489.
Childers, R., III, 184.
Chimes, III, 303.
Chinard, G., III, 361.
Ch'in Chu-sheo, II, 353.
Chintamani, Rasendra, II, 325.
Chirac, P., II, 59; III, 27.
Ch'in-Ch'ang-Ch'un, II, 260.
Chodat, R., III, 123.
Choulant, J. L., II, 152.
Christ, H., II, 267.
Christian V *of Denmark*, III, 337.
Christiansen, C. C., II, 457.
Chrysippus, II, 67, 78.

Chrystal, G., III, 417.
Chuquet, N., III, 339.
Church, H. M., II, 272.
Cicone, C., II, 57.
Ciscato, III, 439.
Çivaditya, III, 244.
Clairaut, A. C., III, 438.
Clare, *Saint*, II, 479.
Clarellis, L. (de), II, 79.
Clark, A. C., III, 136.
Clark, A. H., III, 116.
Clark, C., II, 479.
Clark, V. S., III, 132.
Clarke, A. C., III, 439.
Clarke, E., II, 271.
Clarke, F. W., III, 358.
Clarke, J. M., III, 116.
Clasen, P. A., II, 308.
Clausius, II, 282.
Clay, A. T., III, 347.
Clebsch, A., III, 418.
Clemen, O., III, 346, 465.
Clement, *of Alexandria*, II, 432.
Clements, E., III, 208.
Cleopatra, *alchemist*, III, 303.
Clerget, P., II, 462.
Cleu, H., II, 479.
Clifford, W. K., III, 291.
Clusius, C., II, 267; III, 332, 358.
Cluzot, H., III, 124.
Cocchi, A., III, 60.
Cockerell, T. D. A., III, 99.
Coe W. R., III, 116.
Coedès, G., III, 208.
Coessin, III, 116.
Cogan, T., III, 333 sq.
Cohn, E., II, 286.
Cohn, F., II, 288.
Cohn, J., II, 299; III, 16.
Cohn, W., III, 179.
Coindat, *D'*, II, 278.
Colard, A., III, 37.
Colaw, J. M., III, 490.
Cole, F. J., III, 124.
Cole, W., II, 79; III, 23, 28.
Colebrooke, H. T., II, 356.
Coleman, C. B., III, 95.
Coleridge, S. T., III, 277.
Colin, G., II, 431; III, 135.
Colinet, P., III, 179.
Collett, S. D., III, 428.
Collier, J., III, 388, 389.
Collins, F. H., III, 389.
Collomb, II, 373.
Colombier, J., II, 445.
Colombo, G., III, 116.
Colson, A., III, 443.
Columbo, R., II, 57, 85, 87.
Columbus, C., III, 101.
Columcille, III, 480.
Comarios, III, 303 sq.
Comenius, II, 399.
Commart, III, 371.
Compagnoni, A., III, 332.
Compin, P., II, 293.
Comte, A., II, 198, 423 sq., 448; III, 31, 119, 382, 468.
Condillac (de), II, 82, 228, 271.
Condorcet, II, 424.
Confucius, III, 91.
Conklin, E. G., III, 128.
Conving, H., II, 54.
Considère, A., III, 120.
Constable, A., III, 109.
Constantine *the Great*, III, 95.
Constantinus *Africanus*, II, 69; III, 97.
Conti, *l'abbé*, II, 124.
Conway, M. D., II, 450.
Conway, R. S., III, 453.
Cook, A. B., III, 135.
Cook, A. S., III, 322.
Cook, *Sir* E. T., II, 281; III, 122.
Cook, J., II, 395 sq.; III, 463.

Cook, T. A., III, 127.
Coomaraswamy, Ananda K., II, 403-407; III, 103, 137, 139, 206, 207, 208, 472, 473.
Cope, E. D., III, 467.
Copernicus, N., II, 203, 421, 424; II, 367, 494.
Copinger, W. A., II, 264.
Coquiot, II, 103.
Coralnik, A., II, 267.
Corbin, P., II, 288, 455.
Cordemoy, II, 82.
Cordier, H., II, 140, 169, 261, 435; III, 98, 120, 123, 130, 132, 215, 218.
Cordier, P., III, 121, 211.
Corner, G. W., III, 356.
Corney, B. G., II, 272.
Cornford, F. M., II, 254, 431.
Coronel, L., III, 41.
Correa, G., III, 425.
Corsini, A., II, 295, 443; III, 60, 143, 331, 364.
Corson, E. R., II, 276.
Corti, A., II, 278.
Cortier, M., III, 121.
Cosmas, III, 304.
Cossali, II. 353; III, 477.
Costa, E., II, 306.
Costantin, J., III, 123.
Cotes, R., III, 287, 288.
Cotin, *l'abbé*, III, 50.
Cotterill, H. B., III, 479, 480.
Cotton, A., III, 147.
Couchoud, P. L., II, 299, 300.
Couling, S., III, 130.
Coulon, L., II, 371.
Coulter, J. M., III, 161.
Coulton, C. G., III, 487.
Couper, III, 428, 442.
Courant, M., III, 482.
Courbe, A., II, 279.
Courtois, *the elder*, II, 277.
Courtois, Bernard, II, 277.
Cousin, J., II, 70.
Cousin, Victor, III, 13-15, 19, 50.
Coustet, E., III, 116.
Coutard, H., II, 460.
Couturat, L., II, 80, 111, 284; III, 121, 339.
Cowell, E., III, 177, 187, 191, 196, [200.
Craanen, P. (de), III, 23.
Craig, T., III, 416.
Cramer, G., II, 108, 113.
Cranz, P., III, 114.
Crates, III, 305.
Crawford, O. G. S., II, 302.
Crawfurd, R., II, 254, 297; III, 143, 359, 366, 471.
Credner, H., II, 374.
Crerar, J., II, 305.
Crescenzo, N., III, 30.
Cresswell, C. H., II, 272.
Crew, H., II, 442; III, 110, 274, 365, 494.
Çridhara *Acharya*, II, 335, 356; III, 205.
Crispus, B., III, 321.
Croce, B., II, 284.
Croiset, A., II, 431; III, 135.
Croiset, M., III, 92.
Crollius, III, 26.
Crommelin, A. C., III, 364.
Cronheim, W., II, 295.
Crooke, W., III, 204, 205.
Crookes, *Sir* W., III, 120-123.
Croone, W., II, 79.
Crouzet, E., II, 288, 455.
Crucé, E., II, 418-421; III, 460.
Cruchet, R., II, 450.
Crussard, II, 258.
Csoma de Körös, A., III, 210.
Cummings, B. F., II, 276; III, 113.

Cummings, F., III, 185.
Cumston, C. G., III, 346.
Cunningham, *Sir* A., III, 202, 203, 207, 210.
Cunningham, E., III, 146, 364.
Cunningham, J. D., III, 203.
Curdy, E. M., III, 37.
Curie, *M^me^* P., II, 197; III, 147.
Curnock, N., II, 446.
Currie, J., III, 342.
Curtis, J. G., III, 109.
Curtis, M. A., III, 345.
Curtius Rufus, Quintus, III, 208, 209.
Curtze, H., III, 38.
Curtze, M., II, 134, 203; III, 396.
Cusa, Nicolaus (de), II, 265; III, 36.
Cushing, H., II, 199; III, 488.
Cushman, H. E., III, 13.
Cushny, A. R., III, 341.
Cuvier, G., II, 214 sq., 228, 361-363, 371, 424, 447, 467.
Cynewulf, III, 322.
Cyon, E. (de), II, 71, 295.
Czapek, F., II, 464.
Czaplicka, Mary A. C., III, 133, 348.

D

Da Gama, V., II, 415.
Dagnan-Bouveret, J., II, 69, 74.
Dahl, C. F. T., II, 465.
Dahlberg, K. T. (von), II, 278.
Dahll, T., II, 373, 377.
Dahlmann, J., III, 191, 197.
Daintree, R., II, 374.
Dalby, I., III, 439.
Dale, R., III, 340.
Dalen, C. (van), III, 109.
Dall, W. H., III, 116, 121.
Dalton, J., II, 168, 169; III, 427.
D'Alton, J. F., III, 93.
Dana, C. L., III, 109, 143.
Dana, E. S., II, 378; III, 116.
Daniel, *le Père*, II, 81.
Daniel *of Morley*, III, 263-269, 455.
Daniels, C. E., III, 31.
Daniels, F., III, 367.
Danne, G., II, 460.
Danne, J., II, 460.
Dannemann, F., II, 218-222, 456; III, 25, 34, 150, 346.
Dante, II, 385, 440; III, 99.
Darboux, G., II, 107, 134, 282, 286; III, 119, 121, 463, 468.
Darcy, P. *Count*, II, 270.
Daremberg C. V., II, 45, 54, 55, 60, 64, 73, 77, 78, 89; III, 22-25, 28, 30, 32, 35, 36, 47, 48.
Darmanson, II, 83.
Darvillé, W., II, 469.
Darwin, C., II, 232, 366 sq.; 424, 449, 460; III, 345, 379.
Darwin, E., II, 228.
Darwin, F., II, 294.
Dastre, A., II, 41, 56; III, 22, 45.
Daubrée, A., II, 362.
D'Avenel, G., III, 358.
Davenport, C. B., III, 295.
Davenport, E. H., III, 96.
Davids, *M^rs^* C. A. F. Rhys, III, 137, 138, 194.
Davids, T. W. Rhys, III, 193.
Davidson, W. L., III, 113.
Davies, C., III, 416.
Davies, E., II, 469.
Davies, T. S., III, 362.
Davy, *Sir* H., II, 169, 456.
Dawson, G. M., II, 374.
Dawson, M. M., III, 91.
Dawson, W. H., II, 469.

Debierne, A., II, 197.
De Boer, T. J., II, 271.
Debrou, II, 77.
De Castro, J., III, 424, 425.
Déchelette, J., II, 473; III, 121, 148.
Dechen, H. (von), II, 373, 374.
Decker, A. C., II, 73.
Decker, W. F., III, 496.
Decourdemanche, J. A., II, 250, 251, 434.
Dedekind, R., III, 344.
Degerando, F. M., III, 12.
Degering, H., III, 322-324.
Dehérain, H., III, 121.
Dehio, G., II, 441.
Deichert, H., II, 332.
De La Beche, *Sir* H. T., II, 376.
Delage, Anna, II, 295. [390.
Delage, Y., II, 217, 232; III, 49.
Delamain, R., III, 335.
Delambre, II, 401; III, 438.
De Lamétherie, III, 445.
Delaunay, P., II, 263.
Delbos, V., II, 40.
Delbrück, B., III, 181, 182.
Delbrück, R., II, 250 sq.
Delépine, M., II, 293.
Delgrado, J. F. N., II, 373.
Del Lungo, C., III, 367, 493 sq.
Del Lungo, I., III, 332.
Delmas, P., II, 296.
Del Papa, G., II, 51.
Del Rio, *Alcalde*, II, 237.
Delvolvé, J., II, 301.
Demetrius, A., II, 298.
Démeunier, J. N., II, 198, 302, 473.
Democritus, II, 69; III, 91.
Demolins, E., II, 471.
De Morgan, A., III, 109, 117, 283-285 ,291, 414, 460.
Dendy, A., III, 371.
Denmore, Frances, III, 359.
Dennefeld, L., III, 349.
Denoye, III, 371.
Denucé, J., II, 462.
Denys, J.-B., II, 60.
Deonna, W., II, 100-105, 254, 305, 306, 473, 475, 476; III, 133, 481.
Deromps, M., III, 201.
Désargues, G., III, 109.
Descamps, P., II, 469.
Descartes, R., II, 37-89, 106-124, 223, 228, 230, 268, 269, 358, 424, 442, 443; III, 21-58, 111, 112, 282, 286, 335, 392, 393, 461.
Deslandes, II, 211.
Deslandres, H., III, 61.
Desmarets, N., II, 370.
Des Marez, G., II, 168.
Desnos, E., II, 466.
Destrée, J., II, 440.
Detilleux, A., III, 117.
De Toni, G. B., III, 60, 103, 113, 332, 459.
Deussen, P., II, 279, 407 sq.; III, 139, 188, 190, 191, 193, 197, 305, 473.
Devic, L., III, 217.
De Vries, H., II, 271, 465; III, 61, 117.
De Vrijer, M. J. A., III, 460.
Dewing, H. B., III, 321.
Dhalla, Maneckji Nusservanji, III, 139.
Dhanika, III, 199.
Dharmottara, III, 247.
Dickinson, H. N., III, 115.
Dickson, L. E., III, 141, 446-448, 489, 491.
Diderot, D., II, 272.

Diderot, D. P., II, 273.
Diehl, C., III, 349.
Diels, H., II ,254, 431; III, 319, 327, 348, 433 sq., 470, 482, 497.
Diemerbroeck, I. (van), II, 62-70; III, 328.
Diepgen, P., II, 264, 272, 296.
Diesel, R., III, 497.
Dieterici, F. H., III, 305.
Dietrich, II, 282.
Dilling, W. J., II, 296.
Dilly, II, 83; III, 51.
Dimitrova, Z., II, 71.
Dines, W. H., III, 61.
Dinesh Candra Sen, III, 186.
Dingler, H., II, 309.
Diodorus, III, 208.
Dionis, II, 55, 70; III, 34.
Dionis du Séjour, A. P., III, 438.
Diophantus *of Alexandria*, II, 336, 341, 354-356.
Dioscorides, III, 357, 435.
Ditmar, R., II, 279.
Dittrich, A., II, 267.
Dixon, H. B., III, 61.
Dobson, J. F., III, 91.
Dodart, D., III, 36.
Doehlemann, K., II, 306.
Doin, O., III, 270.
Dolomieu, D., III, 464.
Donath, E., II, 281.
Dontcheff-Dezeuze, M^me^, II, 468.
Donzellini, J., III, 22, 30.
Doran, A. H. G., II, 272.
Dörbeck, F., II, 296.
Dorveaux, P., II, 256, 262, 276, 448, 467; III, 346.
Dostojevsky, II, 239.
Doucet, J., II, 476.
Dowson, J., III, 185, 188, 217.
Draescke, J., II, 438.
Drahn, H., II, 142.
Drake, F. R., III, 147.
Drake, J., II, 65.
Drake, M., III, 149.
Drake, R., II, 54.
Drake, W., III, 149.
Drechsel, C. F., II, 463.
Drews, A., II, 251.
Dreyer, J. L. E., III, 94, 105, 455, 458.
Driesch, H., III, 127, 439, 483.
Druce, G. C., II, 271.
Drummond, II, 280.
Dryander, J., II, 45.
Drysdale, C. V., II, 469.
Dubois, P., II, 291; III, 98, 281.
Dubois, R., II, 460.
Du Bois-Reymond, E., II, 74; III, 346, 391, 484.
Dubreuil-Chambardet, L., II, 438; III, 97, 279 sq., 455.
Duchesne, III, 26.
Du Chesne, J., III, 464.
Dudeney, H. E., III, 143.
Duff, C. Mabel, III, 83, 202.
Dufour, H., III, 216.
Dufrénoy, II, 372.
Dugas, L., II, 279.
Duhamel, III, 36.
Duhem, P., II, 97, 164, 203 sq., 206, 264; III, 36, 37, 39-42, 54, 104, 109, 121, 125, 337, 339, 434.
Dühring, E., III, 324.
Dulaure, J. A., II, 473.
Dulaurier, II, 199.
Dulong, P. L., III, 427.
Dumas, J. B., II, 277, 279, 424; III, 427.
Dumont, A., II, 372, 380.
Dumont, E., II, 447.
Duncan, D., III, 388.
Duner, N. C., III, 121.

Dunlop, B., II, 469.
Dunoyer, L., II, 197, 457.
Duns *Scotus*, II, 85; III, 39, 42, 280.
Dunstan, A. E., II, 456.
Dupréel, E., II, 301.
Dupuis, C. F., II, 473.
Durkheim, E., II, 308, 469; III, 205.
Duroiselle, C., III, 184.
Durrieu, P., III, 124.
Duruy, V., II, 199.
Durville, G., II, 252, 307.
Dusolier, III, 36.
Dussaud, R., II, 308; III, 148.
Dutt, M. N., III, 198.
Duval, M., II, 74; III, 37.
Dyroff, A., II, 264.
Dyroff, K,. II, 428.
Dyson, F., III, 364.
Dyson-Perrins, C. W., II, 440.

E

Eales, Nellie B., III, 124.
Eastman, C. R., II, 294; III, 101; 111, 153.
Eastwick, E. B., II, 402; III, 181.
Eaton, A., II, 376.
Ebstein, E., II, 266, 279, 296, 443; III, 113, 345, 367, 463.
Echt, B. (von), III, 439.
Eddington, A. S., III, 121, 364.
Edkins, J., III, 214.
Edmunds, A. J., III, 209.
Edrisi, III, 455.
Edwards, M., II, 198.
Effertz, O., II, 298.
Effront, J., II, 292.
Eggeling, J., III, 177, 189.
Ehmcke, F. H., II, 204.
Ehrenberg, II, 212.
Ehrlich, E., II, 301.
Ehrlich, P., II, 200.
Eichhorn, G., II, 291.
Eights, J., III, 116.
Einstein, A., II, 194, 287, 289, 454; III, 364, 491.
Eisenstein, G., III, 417.
Eisler, R., II, 433.
Eitel, E., III, 213.
Eitelberger von Edelberg, R., III, 322.
Elbogen, I., II, 434.
Elias, N., III, 218.
Eliot, T. S., III, 111.
Elliot, G. F. S., III, 148.
Elliot, H. S. R., III, 346, 389.
Elliott, *Sir* H. M., III, 217.
Elliott, J. S., II, 253.
Ellis, R. L., II, 85.
Elmore, W. T., III, 196.
Elsholz, G. S., III, 340.
Elst, R. (van der), II, 431.
Ely, R. T., III, 132.
Emery, M., III, 22.
Emmanuel, M., III, 482.
Emmons, S. F., II, 374.
Empedocles, III, 317.
Endo, T., II, 24.
Endres, II, 49.
Eneström, G., II, 135-137, 156, 262, 285; III, 98, 105, 109, 122, 396.
Engel, F., II, 138, 272, 445.
Engeln, O. D. (von), III, 105.
Engerrand, J., II, 170 sq., 232-234, 377; III, 98, 152.
Enlart, C., III, 353.
Enriques, F., II, 284, 286; III, 368 sq.
Enriques, P., II, 292.
Ent, G., II, 50, 54. 58,
Ephraim, J., III, 463.

Equilbecq, F. V., II, 303.
Erasistratus, II, 67, 73.
Erasmus, II, 264, 265; III, 104, 105, 278.
Erastus, III, 26.
Erdmann, A., II, 377.
Erdmann, J. E., II, 42; III, 38.
Escard, J., II, 464.
Escher von der Linth, A., II, 373, 390.
Espérandieu, E., II, 254.
Espinas, A., III, 42, 43, 51.
Esquivol, J. E. D., II, 299.
Esra, *Rabbi* ben, (Avénard), III, 98.
Estienne de la Rivière, C., II, 56, 69.
Estrée, P. (d'), II, 444.
Esty, E. T., III, 345.
Etheridge, R., II, 374.
Eucken, A., II, 196.
Eucken, R., II, 480; III, 42.
Euclid, II, 256, 354, 355; III, 92, 307, 318, 343, 453.
Euctemon, II, 255.
Euler, L., II, 113, 114, 118, 122, 165 sq., 181, 272, 273, 445; III, 115, 438, 447.
Euripides, II, 256.
Eustachius, B., II, 43, 45, 57, 213, 265, 441; III, 38, 332.
Eutocius, III, 92, 93.
Evans, *Sir* A., III, 148.
Evans, G. W., III, 461.
Evelyn, J., II, 268.
Evelyn-White, H. G., III, 317, 321.
Everett, A., II, 374.
Evershed, M^rs^ John, *see* Orr, M. A.
Ewart, J. C., III, 61.
Eymin, III, 23, 32.

F

F. M. F., *see* Feldhaus, F. M.
Faber, J., II, 61.
Fabre, J. H., II, 397; III, 467.
Fabre, P., II, 50.
Fabre, P. J., III, 26.
Fabri, H., II, 57.
Fabricius, *ab Aquapendente*, II, 44, 49, 56, 87.
Fabry, C., III, 147.
Faddegon, B., III, 192.
Fadl, abu'l ga'far, ibn' Ali al Dimaschq, II, 435.
Fadl Allah Rashid Ed-Din, III, 217.
Fa-Hien, III, 214.
Faider, P., II, 168.
Failret, J. P., II, 299.
Faller, A., II, 402.
Fallope, II, 43, 55, 57, 88.
Fanari, Al., III, 456.
Fanien, III, 270.
Faraday, M., II, 169, 223, 427, 456; III, 275.
Farnell, L. R., II, 431.
Farquhar, J. N., III, 181.
Fauche, H., III, 199.
Faulmann, C., II, 478.
Faure, E., II, 264.
Fausböll, V., III, 200.
Faust, E. A., III, 105.
Favaro, A., II, 134, 167, 264, 267, 268, 440, 442; III, 60, 103, 105, 110, 121, 330, 337, 359, 457, 461, 493 sq.
Favaro, G., II, 440; III, 103, 330.
Faye, II, 192.
Faye, E. (de), II, 432; III, 94.
Febvre, L., II, 306.
Fechheimer, Hedwig, III, 133.
Fechner, G. T., III, 152.

Fedeli, C., III, 364.
Feer, L., III, 200, 211.
Fehlering, H., III, 341.
Fehr, H., II, 453.
Feis, III, 319.
Feldhaus, F. M., II, 291, 398, 448, 458, 459; III, 153, 322 sq., 328, 337, 341, 3[illegible]4, 356, 357, 370, 458, 463.
Feldman, W. M., III, 479.
Fenellosa, E. F., II, 260.
Fenner, C. N., III, 493.
Ferckel, C., II, 261, 262; III, 325.
Fergil *of Salzbourg, see* Virgil, *saint.*
Ferguson, A., III, 289.
Ferguson, J., II, 268.
Ferguson, J. C., III, 130, 349.
Fergusson, J., III, 207.
Ferishta, III, 217.
Fermat, P. (de), III, 111, 112, 255-262, 338, 392, 447, 460.
Fernel, J., II, 68, 73, 78; III, 36, 43.
Féronce, E., III, 335.
Ferrari, G., II, 276.
Ferree, C. E., II, 458.
Ferri, G., III, 456.
Ferri, L., II, 276.
Ficalho, *conde* de, II, 415; III, 459.
Fick, A., III, 182.
Fick, R., III, 176, 183, 197.
Ficklin, J., III, 416.
Fiedler, W., III, 418.
Fienus, T., III, 42.
Fierens-Gevaert, II, 476.
Figard, L., II, 78; III, 36.
Figari, A., III, 60.
Figuier, L., II, 101.
Filassier, A., II, 299.
Finch, III, 111.
Findlay, A., III, 129.
Finke, H., II, 433.
Finkel, B. F., III, 490 sq.
Finkenstein, III, 25.
Finot, L., III, 172.
Firdausi, III, 475.
Firmat, G., II, 439.
Firmicus Maternus, Julius, III, 321.
Fischer, A., II, 477.
Fischer, H., III, 497.
Fischer, I., II, 296.
Fischer, J., II, 264, 293; III, 422.
Fischer, K., II, 53.
Fischer, K. T., II, 451.
Fischer, L. A., II, 456.
Fischer, P., III, 438.
Fischer, W. K., III, 91.
Fiske, W., III, 99.
Fitton, II, 370.
Flamsteed, J., II, 421; III, 284.
Fleet, J. F., II, 356; III, 180, 203.
Fleming, J. A., III, 61.
Flett, J. S., III, 121.
Flexner, A., II, 469.
Flexner, S., III, 365.
Flourens, M. J. P., II, 54, 55-57, 77, 79, 84, 280; III, 46.
Flournoy, II, 105.
Fludd, R., II, 45.
Fobes, F. H., III, 278 sq.
Focillon, H., II, 476.
Foerster, W., II, 263.
Folet, H., II, 52.
Foley, E. J., II, 300.
Foligno, G. (da), II, 263.
Fonahn, A., II, 265, 440; III, 104.
Fontenelle, III, 27.
Foote, H. W., III, 116.
Foote, R. B., III, 138.
Forbes-Leith, W., III, 106.
Forbin, V., II, 430.

Ford, W. E., III, 116.
Fordham, *Sir* H. G., III, 134.
Foreest, P. (von), II, 266.
Formichi, G., III, 92.
Formiggini, A. F., II, 207, 292.
Förstemann, E., III, 292.
Forster, E. S., III, 91.
Forsyth, A., III, 439.
Forsyth, C., III, 124.
Fossel, V., II, 150, 265, 304; III, 332.
Fosseyeux, M., II, 268, 270, 279, 305, 445.
Foster, *Sir* M., II, 45, 50, 51, 57-59, 61, 64-66, 73, 87; III, 23, 27, 28, 31, 33-35, 45-47.
Fotheringham, J. K., III, 93.
Foucart, G., II, 253.
Foucart, P., III, 135.
Foucher, A., III, 138, 206, 207, 209, 211.
Fougères, G., II, 431.
Fouillée, A., II, 41, 61, 76, 309; III, 46.
Foulet, L., II, 272.
Fourcroy, A. F., III, 342, 344.
Fourier, J. B. J., III, 117.
Fournereau, L., III, 216.
Fowle, F. E., III, 147.
Fowler, A., III, 61.
Fowler, Mary, III, 99.
Fowler, W. W., II, 205, 432.
Fox-Strangways, A. H., III, 208.
Fracassini, A., III, 45.
Fracastoro, G., III, 36, 102, 106, 107, 334.
Francé, R. H., II, 169.
Franceschi, P., III, 102.
Franchet, L., III, 366.
Francke, A. H., III, 322.
Francœur, III, 438.
Françosius, II, 52.
Frank, T., II, 432.
Franke, O., III, 97, 130, 184, 214.
Frankfurter, O., III, 184.
Frankland, III, 428.
Frankl-Hochwart, II, 71.
Franklin, B., II, 456; III, 112, 114.
Franz, V., II, 299.
Frascators, G., III, 459.
Frati, L., III, 327.
Fraunhofer, III, 119.
Frazer, *Sir* J. G., II, 101; III, 127, 129, 133, 320.
Frazer, R. W., III, 138.
Frech, F., II, 291.
Frederick II, *Emperor*, II, 262, 439.
Frege, G., III, 311-313, 363.
Freiberg, Dietrich (von), II, 206, 440; III, 327.
Freimark, H., II, 272.
Freind, III, 36.
Freire-Marreco, Barbara, III, 134.
Freise, F., II, 459.
Freitag, II, 84.
Frenzel, M. A., III, 114.
Frere, Catherine F., II, 208; III, 106.
Fresnel, A. J., II, 181.
Freud, S., II, 468; III, 104.
Freundlich, H., II, 465.
Freytag, F., II, 152.
Friedberg, S. A., III, 113.
Friederici, C., III, 175.
Friendlaender, I., II, 464.
Fries, J. E., III, 125.
Frimmel, F. (von), III, 349.
Frischeisen-Köhler, M., II, 243 sq., 287; III, 145.
Fritz, F., III, 337.
Froidevaux, H., III, 121.

Froriep, A. (von), II, 276.
Frost, Laura, II, 276.
Frothingham, A. L., III, 124.
Fuchs, L., III, 333.
Füchsel, G. C., II, 370.
Fueter, E., II, 478; III, 136.
Fujisawa, *Prof.*, II, 410.
Fujishima, III, 215.
Funck-Brentano, F., III, 115.
Furtmüller, C., II, 468.
Furttenbach, J., *the elder*, II, 269.
Furukawa Kunshô, II, 29.
Furukawa Ujiichi, II, 25.
Fuster, E., II, 468.

G

Gahiz, al, III, 353.
Gaizo, M. (del), II, 442.
Galen, II, 43, 49, 52, 58, 62, 67, 68, 73-78, 88, 204 sq., 228, 254, 255, 431; III, 24, 25, 43, 94, 319, 320, 351, 435.
Galilei, Galileo, II, 96, 228, 267, 268, 422, 424, 442, 443; III, 103, 105, 110, 337, 432, 461, 493.
Gall, F. J., II, 447; III, 345.
Galle, II, 192.
Gallendat, *D'*, II, 273.
Galli, M., III, 35.
Gallichan, W. M., II, 469.
Gallipus, III, 267.
Gallois, II, 70.
Gallot-Lavallée, P., II, 445.
Galloway, J., II, 466.
Galton, F., II, 449; III, 295.
Galvani, II, 456.
Gamber, J., II, 462.
Gand, Henri (de), III, 39.
Gantzer, II, 266.
Ganzenmüller, W., III, 354.
Garbe, R., II, 402; III, 138, 184, 191, 198, 209, 221, 251.
Garboe, A., III, 337, 497.
Gardner, P., II, 431; III, 210.
Gardner, W. M., III, 117.
Gari Achmed Muchtar, III, 353.
Gariopontus, III, 355.
Garnier, C. M., III, 361.
Garrett, H. L. O., III, 203.
Garrison, F. H., II, 296, 307; III, 108, 113, 117, 135, 144, 458, 463.
Gärtner, C. F. (von), III, 345.
Garzoni, T., II, 442.
Gaskell, W. H., III, 121.
Gasquet, F. A., III, 99.
Gassendi, P., II, 45, 53-55; III, 24, 35, 335.
Gastaldi, G., III, 458.
Gastaldy, J. B., II, 59.
Gastoué, A., III, 482.
Gaub, L., II, 262.
Gaubius, J. D., III, 45.
Gauchet, L., III, 131, 456.
Gaudin, II, 277.
Gauja, P., III, 152.
Gaulthier, J. (de), II, 105.
Gauss, C. F., II, 180, 277, 287; III, 414, 438.
Gautama Akshapada, III, 230, 242, 250.
Gauthier, H., II, 436.
Gauthier, J. A., II, 266.
Gauthier-Villars, III, 492, 496.
Gauthiez, P., III, 99.
Gauthiot, R., III, 182, 212.
Gautier, A., III, 110, 295.
Gautier, H., II, 156, 279.
Gauves, Y., III, 31.
Gay-Lussac, J. L., II, 168, 277; III, 427.

Gazali, II, 258.
Gazari, al, III, 324, 478.
Gazier, F., II, 443.
Geber (Jabir B. Hayyan), III, 305.
Gebhardt, M., II, 285.
Gebhardt, O., III, 465.
Geden, A., III, 190.
Geffcken, J., II, 431.
Gehema, J. A. a., II, 271.
Geiger, W., III, 182-184, 203.
Geikie, *Sir* A., II, 374, 376-394, 432; III, 61.
Geikie, J., II, 302; III, 121.
Geist, H., III, 94.
Geitel, M., III, 370.
Geldner, K., III, 187, 188.
Gemelli, A., II, 309.
Genez, A., II, 291.
Genil-Perrin, G., II, 267, 443.
Gennep, A. (van), II, 302, 473.
Genovesi, A., II, 274.
Gény, F., II, 469.
Geoffroy, II, 214-216.
Geoffroy Saint-Hilaire, I., III, 29.
George, *Saint*, II, 479.
Georges-Berthier, A., II, 37-89, 209-213, 216 sq.; III, 21-58, 110, 113, 461.
Gerard *of Cremona*, III, 267, 324.
Gerbert, *Pope* Sylvester II, II, 206; III, 264.
Gercke, A., II, 431.
Gerhard, G. A., II, 431.
Gerhardt, C. F., II, 277; III, 119, 427, 428.
Gerhardt, C. I., II, 81; III, 110, 284, 337, 339, 397.
Gerhardt, J., III, 114.
Gerini, G. E., III, 209.
Gerlich, F., II, 469.
Gernardus, II, 262; III, 98, 396.
Gérono, II, 133.
Gerzon, Levi ben, III, 38.
Gerster, K., III, 332.
Gesner, K., III, 332, 334.
Geuthner, P., II, 198.
Geyl, A., II, 266.
Ghalib, III, 267.
Ghate, V. S. III, 193.
Gherardi, A., III, 332.
Ghini, L., III, 60.
Ghiyas ud-Din Jamshid, II, 413.
Ghulam Husain Salim, III, 217.
Giacomelli, R., III, 330.
Giard, A., II, 217.
Gibbons, H. A., III, 100.
Gibbs, J. W., II, 177, 178, 180, 182.
Gibson, Agnes C., III, 206.
Gibson, G. A., III, 110, 334, 339.
Gibson, J., III, 110.
Gibson, J. P., III, 272.
Gibson, W. R. R., III, 12.
Gide, C., III, 132.
Gignoux, M., II, 294.
Gilbert, L., II, 454.
Gilbert, W., II, 442; III, 107.
Gilbertus *Anglicus*, III, 325.
Gildemeister, J., III, 175.
Giles, H. A., III, 131, 349.
Giles, L., III, 95, 98.
Gill, *Sir* D., III, 121.
Gill, E., II, 404.
Gill, T. N., III, 121.
Gillet, L., II, 444.
Gilson, E., II, 43, 49, 76; III, 50, 53, 55, 57.
Gini, C., II, 454.
Ginsburg, J., III, 98.
Ginzel, F. K., III, 132.
Giordano, D., II, 296; III, 332.
Giordano, F., II, 377.

Giovanaozzi, P. G., III, 338, 493, 494.
Giraud, P., II, 460.
Gironcourt, G. (de), II, 474.
Givry, G. (de), II, 441.
Gjellerup, III, 75.
Glaeser, G., II, 370.
Glaisher, J. W. L., III, 339.
Glauber, J. R., III, 335.
Gley, E., II, 295; III, 117.
Glisson, E., II, 443.
Glisson, F., II, 64, 77, 78, 228, 443.
Gmelin, L., II, 279.
Gmunden, Johannes (von), II, 263.
Gobert, E., II, 258.
Gobineau, J. A. (de), II, 449.
Goblet d'Alviella, E. F. A., II, 308; III, 209.
Goblot, E., II, 284, 452; III, 21, 43, 145, 306, 391-395, 461, 488, 494.
Gockel, A., II, 464.
Godron, D. A., III, 345.
Goes, D. (de), III, 425.
Goes, H. (van der), II, 440.
Goethe, II, 213-216, 275, 277, 278, 447, 448; III, 114, 342, 343, 464.
Goetz, J. W., II, 440.
Goffin, J. G., II, 453.
Goguet, A. Y., II, 302, 473.
Gohory, J., III, 26.
Goldenring, R., III, 344.
Goldschmidt, II, 217.
Goldschmidt, R., II, 460.
Goldsmith, Marie, II, 232.
Goldziker, J., III, 39.
Gollancz, H., III, 269.
Gollancz, J., II, 172.
Golligher, W. A., III, 388.
Gomberg, L., II, 291.
Gomès Teixeira, F., III, 141.
Gomperz, T., II, 72; III, 42.
Gooch, G. P., II, 447.
Good, H. G., III, 341.
Goodale, G. L., III, 116.
Goodman, J. T., III, 292.
Goodwin, H., III, 415, 417.
Goodyear, C., II, 279.
Gopinatha Rau, T. A., III, 138.
Gorceix, S., II, 308.
Gordin, A. M., III, 363.
Gordon, Bernard (de), II, 262.
Gorgas, W. C., III, 117, 120.
Görres, J., III, 342.
Göschen, II, 290.
Gossen, J., III, 320.
Gosset, P., II, 273.
Gossner, B., II, 456.
Gothein, Marie L., III, 124.
Gothofredus, J., III, 321.
Goto Kakubei, II, 25.
Gottesmann, B., II, 309.
Gottleib, T., III, 354.
Göttling, III, 464.
Gotzkircher, S., III, 355.
Gonault, E., II, 460.
Gough, A. E., III, 190, 191.
Goulard, R., II, 273, 447.
Gouvea, A. (de), III, 425.
Gowen, H. H., II, 260.
Gower, H. D., III, 125.
Goya, II, 299.
Graaf, R. (de), II, 87.
Grabmann, M., II, 257.
Grabowski, J., II, 266.
Graefe, E., III, 354.
Graeven, H., II,254.
Graham, T., II, 169.
Grammont-Lesparre, A. (de), II, 292.
Grand'Eury, C., III, 121.

Grandjean, II, 105.
Grandjean, Dr, II, 273.
Granet, M., II, 435.
Grangée, F. M., II, 273.
Grasset, J., III, 88, 484, 492.
Grassmann, H., II, 174-179, 182; III, 117, 187.
Graves, F. P., II, 477.
Gravier, C., II, 292.
Gray, A., III, 106.
Gray, R. K., II, 218.
Greaves, J., II, 413.
Gréber, J., III, 361.
Greco, F. (del), II, 299.
Green, Alice S., III, 136.
Green, G., II, 180.
Green, John R., III, 136.
Green, Joseph R., III, 129, 357.
Greene, E. L., III, 297 sq.
Greenough, G. B., II, 371, 372.
Gregory, *Saint of Tours*, III, 95, 354.
Gregory, H. E., II, 375; III, 116.
Gregory, J. C., III, 128.
Gregory, *Sir* R. A., III, 61, 150.
Gresham, II, 421.
Grierson, *Sir* G. A., III, 186, 210.
Griffith, F. Ll., II, 430; III, 122.
Griffith, R., II, 371, 372.
Griffith, R. T. H., III, 187, 188.
Griffiths, J., III, 208.
Grill, J., III, 188.
Grillo, F., II, 449.
Grisellini, F., III, 113.
Groll, M., II, 375.
Gros, C., II, 291.
Gross, C., III, 136.
Gross, V., II, 476.
Grosset, J., III, 482.
Grosseteste, Robert, III, 263, 280 sq.
Grossmann, M., II, 287.
Grote, G., III, 14 sq., 19.
Grothe, H., II, 240, 428.
Grotius, II, 420.
Grotthuss, T. (von), III, 465.
Grube, III, 305.
Gruelin, III, 23.
Grunert, J. A., III, 438.
Grünwedel, A., III, 206, 211, 212.
Gruvel, A., II, 303.
Gsell, S., II, 251, 462.
Guardia, III, 32, 47.
Guareschi, I., II, 92, 276, 279, 448, 457; III, 113.
Guasti, C., II, 267.
Gubair, ibn, III, 353.
Gubler, III, 23.
Gudernatsch, III, 484.
Gudger, E. W., II, 269; III, 154, 370.
Guer, II, 85.
Guerard, A. L., II, 279.
Guericke, O. (von), III, 334, 339, 459.
Guérin, A., II, 279.
Guérinot, A., III, 195, 203.
Guertler, W., II, 289.
Guétrot, M., II, 254.
Guettard, J. E., II, 358, 370.
Guglielmini, D., II, 60, 64; III, 22, 30, 44.
Guiart, J., II, 306.
Guicciardini, F., III, 332.
Guichard, C., III, 121.
Guieysse, II, 199.
Guillaume, C. E., II, 288; III, 146.
Guilleminot, H., II, 460; III, 296, 484.
Guimares, R., II, 145; III, 106.
Guimet, E., 252, 430.
Guinet, L., II, 229 sq.; III, 88 sq., 295-297, 426-428, 445 sq., 448 sq., 466, 484, 485, 492.

Guirand, F., III, 120.
Guisan, A., II, 273.
Guitard, E. H., II, 152, 299.
Gümbel, K. W. (von), II, 373, 376.
Gunadhya, III, 200.
Gunavarman, III, 214.
Gundersen, A., III, 129.
Gundissalinus, III, 145.
Gunter, E., III, 335.
Günther, J., II, 57.
Gunther, R. T., III, 110, 468.
Günther, S., II, 153, 276, 296, 356; III, 341.
Güntz, M., II, 141; III, 485.
Güntzel, H., II, 152.
Gurlt, E., II, 45.
Gusman, P., III, 124.
Gutenberg, J., II, 399 sq.
Guthe, III, 324.
Guthrie, L., II, 269, 276.
Guttenberg, K. (von), II, 294.
Guye, P. A., III, 122.
Guyot, M., III, 114.
György, T. (von), II, 150, 269.

H

Haag, J., III, 146.
Haas, A. E., II, 288, 456; III, 35, 366.
Haas, G. C. O., III, 176, 199.
Haas-Lorentz, G. L. (de), II, 289.
Haberling, W., II, 269; III, 354, 361.
Hackenschmidt, II, 273.
Hackin, J., III, 211, 473.
Hadlich, H., II, 306.
Hæckel, E., II, 449.
Hæckel, W., II, 449.
Haentzschel, E., II, 273; III, 338.
Haeussler, E. P., III, 338, 339.
Hafiz, III, 475.
Hagen, H. A., III, 371.
Haidinger, W. (von), II, 376.
Hain, L., II, 264.
Hahn, C. (von), II, 269, 307, 467.
Hakluyt, R., III, 106.
Halbfass, W., II, 292.
Haldane, *Viscount*, II, 309.
Hale, G. E., III, 120, 152, 368.
Hales, A., II, 49, 280.
Hales, S., II, 62; III, 28, 113.
Hall, Fitzedward, III, 191, 197, 199.
Hall, *Sir* J., II, 362.
Hall, H., II, 433.
Hall, H. R., III, 148.
Haller, A., II, 282; III, 440.
Haller, A. (von), II, 51, 59, 62, 79, 228, 445, 448; III, 33.
Halliday, W. H., II, 254.
Halliwell, J. O., II, 153; III, 396.
Hallopeau, L. A., III, 129.
Halloy, O. (d'), II, 371.
Halphen, G. H., III, 117, 439.
Halsted, G. B., II, 257, 451; III, 343, 344.
Halys, P., III, 122.
Hamberger, III, 45.
Hambruch, P., III, 486.
Hamburger, H. J., II, 460, 461.
Hamdallah, III, 99.
Hamelin, O., II, 40, 74, 83; III, 53, 54, 57, 58.
Hamer, W. H., II, 281.
Hamilton, R. W., II, 174-182; III, 116.
Hamilton, Sir W. R., III, 289.
Hammer-Jensen, Ingeborg, III, 279, 320.
Hammourabi, II, 251.
Hanbury, III, 305.
Handcock, P. S. P., III, 127.

Handerson, H. E., III, 325.
Hankel, H., III, 277.
Hannover, A., III, 345.
Hanotaux, G., II, 469.
Hansemann, D. P. (von), III, 364.
Hansen, P. A., II, 215; III, 439.
Hantzsch, V., II, 428.
Harasin, Gemma, II, 399.
Hardy, E., III, 189, 193.
Hardy, R. S., III, 193.
Hare, III, 149.
Hargreaves, III, 202.
Harichand, III, 199.
Haring, C. H., III, 106.
Hariri, III, 353.
Harlan, W., II, 458.
Harlez, C. (de), III, 179, 213.
Harman, II, 442.
Harnack, A. (von), III, 94.
Harrington, II, 373.
Harrington, J., II, 444.
Harrington, J. P., III, 134, 359.
Harriot, III, 282.
Harris, D. F., II, 267; III, 113, 135.
Harrison, F., III, 389.
Harrow, B., III, 344.
Harsdörffern, G. Ph., III, 338.
Hartill, I., II, 444.
Harting, H., III, 344.
Hartland, E. S., II, 479.
Hartley, D., II, 79.
Hartmann, E. (von), III, 26, 440.
Hartog, M., II, 281.
Harvey, William, II, 43, 52 sqq., 57 sqq., 78, 87, 88, 228, 267, 268, 424, 442; III, 28, 34, 55, 109, 440.
Harvey-Gibson, R. J., III, 297-299, 484.
Hashagen, J., II, 444.
Haskins, C. H., III, 97, 136, 268, 398, 455.
Hastings, W., III, 204.
Hathaway, A. S., III, 338.
Hatzfeld, J., II, 431; III, 135.
Hauber, A., II, 264; III, 454.
Hauchecorne, W., II, 377.
Haug, E., II, 382, 394.
Haug, M., III, 189.
Haukal, ibn, III, 353.
Hauser, F., III, 324, 353, 435, 478.
Häussler, E. P., II, 269.
Hautecœur, L., II, 476.
Hauvette, H., III, 100.
Haüy, III, 445.
Havell, E. B., III, 138, 207.
Havell, H. L., III, 480.
Havers, C., II, 64.
Hayashi, T., II, 9, 11-18, 410; III, 113.
Hayes, C. W., II, 378.
Heath, A. E., III, 117.
Heath, *Sir* T. L., II, 254, 356; III, 262.
Heckscher, A., II, 286; III, 146.
Hecquet, II, 65.
Hector, *Sir* J., II, 373, 377.
Heeg, J., III, 319, 323.
Hefter, A., II, 467.
Hegel, III, 312.
Héger, P., II, 168, 299; III, 25, 106, 122.
Hehn, J., II, 308.
Hehn, V., III, 299.
Heiberg, J. L., II, 203; III, 92, 93.
Heidlauf, F., III, 97.
Heim, A., II, 368, 374.
Heimann, W. J., III, 117.
Heine, A., II, 270.
Heinrich, C., III, 332.
Heinrich, E., II, 267.
Heizman, C. L., III, 144.
Held, F. E., III, 108.

Heliodoros, III, 304.
Hell, B., III, 122.
Heller, H., III, 357.
Hellmann, G., II, 139.
Hellmuth, II, 143.
Helmersen (von), II, 372.
Helmert, II, 192; III, 439.
Helmholt, H. F., II, 239 sq., 428; III, 137, 488.
Helmholtz, H., II, 280, 282.
Helmont, J. B. (van), II, 65, 75 sq., 228; III, 22, 23, 25, 26, 45.
Helmreich, G., II, 431; III, 319, 355.
Helvetius, II, 65.
Henderson, J., III, 359.
Henderson, L. J., III, 128, 152, 439.
Hendricks, J. E., III, 416.
Henke, F. G., II, 260; III, 101.
Hennebicq, L., II, 431.
Henning, H., III, 122.
Henning, J. G. F., II, 84.
Henry, *prince, the Navigator*, III, 102.
Henry, J., III, 116.
Henry, M. C., III, 396.
Henry, T., III, 275.
Henry, V., III, 182, 183, 185, 188, 199, 201.
Henschel, A. W. E. T., II, 143.
Henshaw, N., II, 61.
Heracleitos, III, 135.
Heraclius, III, 305, 354.
Heraklios, III, 304.
Herbart, J. F., II, 278, 399.
Herbert, W., III, 345.
Herbert, William, III, 281.
Herbertson, A. J., II, 462.
Herbertus, B., II, 266.
Herbig, G., III, 136.
Herder, J. G. (von), II, 277, 399.
Hermann, L., III, 484.
Hermannus *contractus*, III, 268.
Hermes *Trismegistos*, III, 303, 348.
Hermite, C., III, 468.
Hero *of Alexandria*, III, 324, 433, 453, 478.
Herold, A. F., III, 190.
Herophilus II, 73.
Herringham, W. P., II, 166.
Herschel, *Sir* J. F. W., III, 291.
Hershey, M. D., II, 280.
Hertling, G. F. (von), III, 325.
Hertwig, O., III, 343.
Hertz, H., II, 181, 456; III, 275.
Hertzka, T., II, 469.
Hervé, G., II, 277, 281, 446.
Hervey de Saint-Denys, M. J. L. (d'), II, 199.
Herzog, R. O., II, 290.
Hesiod, III, 317.
Hess, II, 181.
Hesz, W., III, 461.
Heulhard, A., II, 169.
Heusinger, C. F., II, 143.
Heyde, W., III, 210.
Higgins, B., III, 463.
Highmore, N., II, 78.
Hildebrandt, F., III, 483.
Hildegard *of Bingen, Saint*, II, 261; III, 98, 268, 309.
Hill, A., III, 61.
Hill, D. J., II, 478.
Hill, G. F., III, 141, 397, 403.
Hill, G. W., III, 343.
Hill, M. J. M., III, 307, 490.
Hillebrandt, A., III, 188.
Hillemacher, L., III, 482.
Hillemacher, P., III, 482.
Hillemand, P., II, 268.
Hiouen-Thsang, III, 214.
Hipparchus, II, 204, 355, 401; III, 93.

Hippocampus, III, 153.
Hippocrates, II, 43, 67, 152, 228, 251, 254, 255, 431; III, 25, 43, 317, 319, 325, 348, 351.
Hippolytus, *Saint*, II, 256.
Hirschberg, J., II., 254, 273.
Hirschfeld, M., II, 241 sq.; III, 149.
Hirth, F., II, 436.
His-Schlumberger, Ed., II, 166; III, 115.
Hitchcock, E., II, 376.
Hitti, P. K., III, 140.
Hjett, E., II, 273; III, 440-443, 485.
Hoai Nan Tze, III, 93.
Hoang, P., II, 436.
Hobbes, T., II, 82; III, 12.
Hobbs, W. H., III, 112.
Hobhouse, L. T., III, 131, 134, 145.
Hobson, E. W., II, 285, 442; III, 110, 285 sq., 334, 461.
Hobson, J. A., II, 469.
Hobson, R. L., III, 131.
Hochstetter, F. (von), II, 373.
Hodgson, B. H., III, 211.
Hoefler, M., II, 304; III, 366.
Hoernes, M., II, 232 sq., 302; III, 148.
Hoernle, A. F. Rudolf, II, 356; III, 149, 195, 206, 322.
Hoernle, R. F. A., III, 128.
Hoey, W., III, 185.
Hoff, J. H. (van't), II, 280.
Höffding, H., II, 39, 449.
Hoffmann, F., II, 78, 89; III, 26, 32, 35 sq., 43, 45.
Hoffmann, G., II, 52.
Höfler, A., II, 288.
Hofman, J. J., II, 468.
Hofschlaeger, R., II, 304.
Hogarth, W., II, 299; III, 30.
Hohenheim, *see* Paracelsus.
Holbach, P. H. D., Freiherrn v., III, 462.
Holl, M., II, 265; III, 104.
Holland, T. E., III, 99.
Holländer, E., II, 257, 296, 306.
Hollandus, I., III, 333.
Hollandus, J. I., III, 333.
Holliday, C., III, 144.
Hollmann, S. C., II, 445.
Holman, H., III, 117.
Holmes, C. J., III, 331.
Holmes, W. H., III, 493.
Holste, J., II, 50.
Holtzmann, A., III, 198.
Homberg, W., III, 337.
Hombron, II, 281.
Homer, III, 91, 317.
Hommel, F., II, 474.
Homobonius Piso, II, 53.
Hönigswald, R., II, 309.
Hoogewerff, J. A., II, 455.
Hooghelande, C. (van), II, 59, 62, 65, 77; III, 22.
Hooke, R., II, 61, 169; III, 286 sq., 338.
Hooker, *Lady*, III, 121.
Hooker, *Sir* J. D., III, 61, 121.
Hopkins, A. J., III, 129.
Hopkins, E. W., III, 198.
Hopkins, L. C., III, 350.
Hoppe, E., III, 470.
Hoppe, Marie L., II, 442.
Hopstock, H., II, 265, 440; III, 104, 331.
Horace, III, 93.
Hörle, G. H., II, 433.
Horn, C., II, 447.
Horovitz, K., III, 146.
Horrwitz, E., III, 199.
Horsburgh, E. M., III, 111, 141.

Hort, *Sir* A., III, 92.
Horten, M., II, 258, 434; III, 351, 476.
Horwitz, H. T., II, 260; III, 331, 333, 338, 370, 453.
Hosidius Geta, III, 453.
Hough, L. H., III, 276.
Houllevigue, L., II, 456, 464.
Hourticq, L., II, 476.
Housman, A. E., III, 94.
Houssay, F., II, 230.
Houston, R. A., III, 111.
Hovey, E. O., II, 462.
Hovorka, O. (von), II, 254.
Howard, Clare, II, 265.
Howarth, O. J. R., II, 462.
Howorth, *Sir* H., III, 95.
Hrdlicka, A., II, 303; III, 493.
Hrozny, F., III, 349.
Huart, C., III, 100; 149.
Huarte, II, 68, 81; III, 333.
Huber, E., III, 213.
Huber, M., II, 454.
Huber, R., II, 254.
Hubert, H., III, 205.
Hübotter, II, 260; III, 305.
Hudson, W. H., III, 389.
Huet, P. D., II, 42, 49, 70; III, 50.
Huggins, *Lady*, III, 122.
Huggins, *Sir* W., III, 122.
Hugh *of Lucca*, III, 309.
Hugh-Hellmuth, H. (von), III, 362.
Hugo, *of SaintVictor*, III, 145, 268.
Hugo, V., III, 119.
Hulbert, H., III, 186.
Hultzsch, E., III, 203.
Humbolt, A. (von), II, 169, 364-366, 447.
Hume, D., II, 78; III, 289.
Hunain ibn (Ishak), *ad-Ibadi*, III, 351.
Hunter, J., III, 37.
Hunter, W., II, 450.
Hunter, *Sir* W. W., III, 202.
Huntington, A. T., II, 148, 149.
Huntington, E., III, 361.
Huntington, E. V., III, 146, 496.
Hurgronje, C. S., III, 140.
Huss, J., III, 102.
Huth, G., III, 214.
Hutton, J., II, 360-363.
Huxley, L., II, 282; III, 121.
Huxley, T. H., II, 41, 66; III, 46, 61.
Huygens, C., II, 223, 267, 395, 424; III, 112, 275, 337, 461.
Hyamson, A. M., III, 127.
Hyde, T., II, 414.
Hyde, W. W., III, 113.
Hypatia, II, 336.
Hyrtl, J., II, 68.

I

Ichak, F., III, 364.
Ihne, E., II, 279.
Ijas, ibn, III, 328.
Imbart de la Tour, P., II, 441.
Imagaki Hôkyô, II, 30.
Inge, W. R., III, 95.
Ingram, J. K., III, 132.
Isidor *of Sevilla*, III, 321, 322.
Isis, III, 303, 304.
Isomura, II, 411.
Israily, El, El Harouny, II, 258.
Itard, II, 467.
Ives, G., II, 306.
Ivory, J., III, 439.
Izeki Chisin, II, 24.

J

J., *see* Jourdain, Philip E. B.
J. E., *see* Engerrand, J.
Jack, R. L., II, 374.
Jackman, W. T., III, 132.
Jackson, III, 475.
Jacob, *the patriarch*, III, 129.
Jacob, G., III, 303.
Jacob, G. A., III, 190, 193.
Jacobi, III, 343.
Jacobi, A., III, 113, 120.
Jacobi, H., III, 192, 195, 198, 240, 242, 246, 250.
Jacobi, K. G. J., III, 439.
Jaçomitra, III, 195.
Jadadiça, III, 246.
Jahangir, III, 218.
Jahn, W., III, 196, 197.
Jahns, II, 92, 94.
Jai Sing II, II, 421-423; III, 113, 205, 463.
Jaini, Jagmanderlal, III, 138, 195.
Jamblichos, III, 303.
James, H., II, 376.
James, Henry, II, 281.
James, M. R., III, 470.
James W., II, 281; III, 311.
Jameson, R., II, 359.
Jami, III, 475.
Janet, P., II, 76.
Jantet, C. and H., III, 45.
Janus Plancus, *see* Bianchi, Giovanni.
Jaqut, II, 259; III, 353.
Jardé, A., II, 431; III, 135.
Jarrett, T., III, 415.
Jartoux, II, 412.
Jäschke, III, 210.
Jast, L. S., III, 125.
Jastrow, M., II, 251, 430; III, 126, 349.
Jaumes, III, 46.
Jayne, K. G., II, 415.
Jayne, W. A., III, 351.
Jean, *abbot of St-Nicholas*, II, 439.
Jean *d'Oultremeuse*, III, 100.
Jean, R., II, 449.
Jeanmaire, E., III, 136.
Jeans, J. H., II, 194.
Jeanselme, *Prof.*, III, 270.
Jefferson, T., III, 115.
Jeffrey, H. M., III, 416.
Jelliffe, S. E., III, 365.
Jenkinson, J. W., III, 127.
Jenner, E., III, 113.
Jennings, H. S., III, 128.
Jentsch, E., II, 449.
Jéquier, G., II, 252.
Jerome, *Saint*, II, 67.
Jesus Christ, II, 256, 300, 432; III, 209.
Jeudwine, J. W., III, 144.
Jogodinsky, I., II, 270.
Johannes, *alchemist*, III, 303.
Johannes *of Aquita*, III, 325.
Johannsen, O., II, 291; III, 153, 459.
Johannsen, W., II, 292, 357.
John *of Burgundy*, III, 100, 327.
John *of Damascus, Saint*, III, 96.
John *of Meurs*, III, 100.
John, *Bishop of Norwich*, III, 265.
John, *of Salisbury*, II, 261; III, [145.
Johnson, D. S., III, 129.
Johnson, F., III, 200.
Johnson, R. H., III, 357.
Johnsson, J. W. S., II, 151, 269, 440; III, 328, 345, 364, 365.
Johnston, C., II, 407, 473.
Johnston, G. A., III, 113, 289, 341, 463.

Johnstone, J., II, 461.
Joinville, P. (de), II, 449.
Jolly, J., III, 177, 197, 206.
Joly, A., III, 427.
Joly, H., II, 42.
Jones, C., III, 61.
Jones, E. E. Constance, II, 284.
Jones, H. Lewis, II, 296.
Jones, Horace Leonard, III, 318.
Jones, R., II, 442, 470.
Jones, W. C., III, 276.
Jones, W. H. S., III, 320.
Jonson, B., III, 333.
Jonsson, Finnur, III, 397.
Jordan, A. C., III, 61.
Jordan, C., III, 117.
Jordan, W., III, 439.
Joret, C., III, 299.
Jorgensen, L., III, 113.
Josephson, A. G., II, 159; III, 125, 150, 153.
Josephus, Flavius, III, 319.
Joshi, R., III, 186.
Joubert, L., III, 36.
Jouguet, E., III, 121
Jouguet, P., II, 431; III, 135.
Joule, J. P., II, 223, 282.
Jounis, ebn., II, 413; III, 455.
Jourdain, M., II, 444.
Jourdain, P. E. D., II, 209, 270 sq., 283, 284, 286, 452; III, 109, 111, 117, 277, 282-290, 307, 310-314, 316, 324, 334-339, 343, 344, 361-363, 369, 452, 460, 461, 490, 495.
Jourdan, V. J. C., II, 298.
Jouveau-Dubreuil, G., III, 66 sq., 207, 473.
Jovy, E., II, 269; III, 111.
Joyce, T. A., II, 475; III, 134.
Joyeux, C., II, 277.
Judson, A., III, 215.
Juhannā b. Mâsawaih, III, 454.
Julian, *the Apostate*, II, 433.
Julien S. A., II, 199; III, 200, 213, 214.
Junghuhn, F. W., III, 467.
Jungmann, K., II, 40.
Junkichi Yoshida, II, 437.
Juquelier, P., II, 273.
Jurin, III, 463.
Justin, III, 208.
Justinianus, III, 304.
Just-Navarre, P., II, 269.
Juynboll, H., III, 217.

K

Kabir, III, 101.
Kabitz, W., II, 271.
Kaegi, A., III, 187.
Kaempfer, E., III, 371.
Kahlbaum, G. W. A., II, 139, 153.
Kaiser, E., II, 233 sq.; III, 148.
Kalhana, III, 204.
Kalidasa, III, 199.
Kamil, abu, Shoga b. Aslam, II, 258, 352, 354.
Kammerer, J. F., III, 466.
Kammerer, P., II, 299, 461.
Kanada, III, 65, 238, 250.
Kanngiesser, F., II, 255.
Kant, J., II, 285, 425, 446; III, 49, 289, 312, 440.
Kapila, III, 191.
Karafiat, K., II, 273.
Karkhi, al, II, 258, 355.
Karpinsky, A., II, 374.
Karpinski, L. C., II, 258, 356; III, 96 sq., 100, 101, 269, 274, 362, 363, 396-413, 451-497, passim.
Karppe, III, 87.
Karutz, *D^r*, II, 307.
Kasim el-Antaki, Abu'l, III, 434.

Kassel, K., II, 277.
Katanov, N. F., III, 176.
Kauffmann, J., II, 257.
Kaufmann, A., II, 286.
Kautilya, III, 92, 220.
Kaviraja Kunjalala Bhishagratna, III, 81.
Kaviratna, A. C., III, 69.
Kaye, G. R., II, 313, 326-356, 421-423; III, 113, 138, 205, 351, 463, 473, 477, 489, 490.
Kaye, G. W. C., II, 456.
Kayser, E., II, 394.
Kayserling, II, 282.
Kazi-Zadah Rumi : *see* Salah ud-Din Musa.
Kazwini, II, 258; III, 353.
Keckermann, B., II, 267.
Keene, H. G., III, 138.
Keil, J., III, 31, 36.
Keilhaek, K., II, 393.
Keiser, C. E., III, 349.
Keith, A. Berriedale, III, 84, 176, 189, 191, 473.
Kékulé, II, 194; III, 428, 442.
Kellen, T., II, 449.
Keller, A., III, 468.
Keller, K., III, 464.
Keltie, *Sir* J. S., III, 61, 117.
Kelvin, *Lord*, II, 217 sq., 282; III, 146, 291.
Kempf, N., III, 114.
Kennedy, J., III, 201.
Kennelly, A. E., III, 147.
Kentmann, J., III, 334.
Kepler, J., II, 267, 424, 456; III, 35.
Kérallain, III, 205.
Kergariou, A. (de), II, 449.
Kern, H., III, 193.
Kern, J., II, 273.
Kerschensteiner, G., II, 450.
Ketkar, J., III, 204.
Keussen, H., II, 298.
Keyserling, II, 372.
Keyserling, H., II, 437.
Khanikoff, N., III, 477.
Khowarizmi, al, *see* Muhammed ben Musa.
Khusrau, *Amir*, III, 475.
Kia-Kien Tchou, III, 92.
Kielhorn, F., III, 180, 203
Kierboe, T., II, 255.
Kierkegaard, S., II, 280, 449.
Kikuchi, *baron*, II, 410; III, 140.
Kilian, W., II, 294.
Killingworth, J., III, 101.
Kincaid, C. A., III, 203.
King, C., II, 377.
King, L. W., III, 126.
Kingsbury, J. E., III, 344.
Kingsford, C. L., II, 264.
Kirchenberger, S., II, 296.
Kircher, A., III, 107, 336, 339.
Kirchhoff, II, 181.
Kirkman, T. P., III, 291.
Kishori Lal Sirkar, III, 64, 206.
Kistner, A., II, 281, 288; III, 339.
Kjerulf, T., II, 373, 377.
Klaatsch, H., II, 303; III, 493.
Klatt, J., III, 176.
Klebs, A. C., III, 101, 104, 106, 144, 148.
Klein, A. J., III, 106.
Klein, C., II, 240.
Klein, Félix, II, 277, 286; III, 465.
Klein, Franz, II, 283.
Klein, G., II, 155.
Klemm, III, 172.
Klengel, F., II, 294.
Kliem, F., II, 254; III, 93.
Klinckowstroem, K. (von), II, 155, 459; III, 339, 342, 368, 370, 466.

Klitscher, K., II, 275.
Klug, R., II, 263.
Knapp, W., II, 196.
Knight, A. E., III, 133.
Knight, C. R., III, 149.
Knight, T. A., III, 345.
Knobel, E. B., II, 401, 413-415; III, 94, 101, 453, 457.
Knott, C. G., III, 111.
Knox, A., II, 374.
Knudsen, M., II, 194.
Kobayaski, Téruaki, II, 437.
Kobell, FP. (von), II, 393.
Kobert, R., III, 370.
Koehler, A., II, 271.
Koehne, C., III, 354, 497.
Koffa, K., II, 479.
Kohlbrugge, J. H. F., II, 213-216, 277; III, 114.
Kolbe, H., II, 169; III, 442.
Kolde, Irmgard, II, 288.
König, E., II, 265.
König, J., II, 284.
König, S., II, 271.
Konow, S., III, 199.
Kopciowski, A., III, 349.
Kopf, E. W., III, 122.
Kopff, A., II, 251.
Kopp, III, 442.
Kopp, H., II, 194, 323 sq.; III, 22, 302.
Köppen, W. (von), II, 402.
Kopsch, Fr., II, 294.
Korn, A., II, 183-190, 277; III, 147.
Korschelt, E., II, 294.
Kostyleff, N., II, 468.
Koulakovsky, J., III, 95.
Kouo Cheou-King, III, 456.
Kowaleski, G., II, 181, 272, 444.
Kraepelin, II, 299.
Krall, K., II, 300.
Kramp, C., III, 414.
Krassa, P., II, 290.
Krazer, A., II, 272, 445.
Krebs, N., II, 392.
Kreibig, J. K., II, 447.
Kremers, E., III, 114, 145.
Kreyssig, II, 143.
Kroll, J., III, 348.
Kronecker, F., II, 281.
Kronecker, H., III, 112.
Kronfeld, E. M., II, 294.
Ktesias *the Knidian*, III, 208.
Kugler, F. X., III, 126.
Kühn, C. G., II, 68.
Kuhn, E., III, 176, 182.
Kühnau, R., III, 198.
Kühner, F., II, 216 sq.; III, 118.
Kumarajiva, III, 213.
Kümmel, O., III, 179.
Kunckel, J., II, 270.
Kunkel, B. W., III, 114.
Kunz, G. F., III, 125, 145, 147, 464.
Kunze, F., II, 446.
Kuo, Ping Wen, III, 131.
Kurushima Gita, II, 30, 31.
Küster, E., II, 292.
Kwanno Genken, II, 17, 20, 22, 23, 30, 35.
Kylèn, H., II, 273.

L

Laboulbène, III, 25, 47.
Labrouste, H., II, 457.
La Caille, L. N. (de), II, 396; III, 464.
Lacaze-Duthiers, II, 217.
La Chambre, (Cureau de), II, 43, 81.
Lackenbacher, H., II, 255.
Lacombe, P., II, 309.

Lacote, F., III, 200.
Lacroix, A., III, 152, 464.
Lacroix. E. (de), *see* Crucé, E.
Lactantius, F., II, 49, 69.
Lacumarcino, II, 265.
Ladame, P. L., II, 266.
Ladenburg, A., II, 169; III, 443.
Laënnec, R. T. H., II, 277; III, 346.
Lafaye, G., III, 93.
Lafitau, J. F., II, 198, 302 sq., 473.
Lafitte, J. P., II, 302.
La Forge, L. (de), II, 55, 70; III, 46 sq.
Lagercrantz, O., II, 255; III, 431.
Lagrange, J. L., II, 181, 277, 287; III, 438.
La Grye, B. (de), II, 192.
La Hire, II, 421.
Laignet-Lavastine, M., II, 277.
La Jonquière, A. (de), II, 434.
Lalande, A., II, 309; III, 55, 121.
Lallemand, C., II, 192; III, 496.
Lallemand, J. B. J., II, 79.
Lalouvère, II, 115.
Laloy, L., III, 93.
Lamarck, J. B., II, 50, 216 sq, 362, 424; III, 118, 467.
Lamare-Picquot, II, 198.
La Mazelière, (de), II, 199.
Lamberti, A., II, 269.
Lamé, II, 181.
La Mettrie, II, 41, 60, 65, 70, 79, 81, 82, 88, 445.
Lammens, H., II, 434; III, 95, 454.
Lams, H., II, 273.
Lancisi, II, 60, 64, 70.
Land, J. P. N., II, 444.
Landa, D. (de), III, 292.
Landrieu, M., II, 216 sq.
Lanessan, J. L. (de), II, 86, 229 sq., 273; III, 127.
Lanessan, L. (de), II, 449.
Lanfranc, II, 68.
Lang, C., II, 296.
Langdon, S., II, 251, 430; III, 126.
Lange, F. A., II, 76.
Lange, J., II, 265.
Langevin, P., II, 193, 194; III, 147.
Langley, III, 120.
Langley, A. G., III, 339.
Langley, G. N., III, 21.
Langley, S. P., III, 116.
Langlois, III, 422.
Langlois, C. V., III, 455.
Langlois, J. P., III, 270.
Lankester, *Sir* E. Ray, III, 61.
Lanman, C. R., III, 180.
Lanzweerde, J. B. (de), II, 62.
Lao-Tse, II, 260, 437.
La Paillone, H. (de), II, 397.
Laplace, P. S. (de), II, 277, 287, 424; III, 438.
Lapparent, A. (de), II, 394.
La Ramée, P. (de), II, 268.
La Rivière, L., III, 26.
Larmor, *Sir* J., II, 280; III, 121, 466.
Larrey, D. J., II, 275, 278.
Lasègue, III, 32.
Laskine, E., II, 449.
Lassen, C., III, 185, 202.
Lasswitz, K., III, 36, 42.
Latham, Marcia, III, 125.
La Tourette, G. (de), III, 112.
Lattes, Elia, III, 348, 470.
Laudenbach, M^me^, II, 437.
Laue, M., II, 287.
Laufer, B., II, 260, 435; III, 95, 96, 100, 123, 124, 130, 131, 134,

138, 145, 147, 208, 299-302, 322, 357, 360, 435, 470, 485.
Launay, L. (de), II, 273, 294, 369, 393 sq.
Laurent, A., III, 119, 428, 442.
Laurent, G., II, 424; III, 494.
Laurent, M., II, 451.
Laurie, A. P., II, 306.
Laussedat, *Cdl.*, II, 288.
La Vallée-Poussin, L. de, III, 78, 138, 179, 189, 193, 194, 210.
Lavignac, A., III, 482.
Lavoisier, A. L., II, 51, 61, 424; III, 109, 114, 337, 339, 358, 445.
Law, N. N., III, 92, 138.
Lawrence, L., II, 262.
Leach, A. F., III, 145.
Leaf, W., III, 91.
Le Bel, III, 428.
Lebeuf, A., III, 125.
Leblanc, N., III, 445, 463.
Lebon, E., II, 282, 398; III, 119, 121.
Leboucq, H., II, 168.
Le Cat, II, 79.
Lechalas, G., III, 121.
Le Chatelier, H., II, 156, 277, 465.
Leclerc, L., II, 448; III, 346.
Leclerc, R., II, 438.
Leclère, A., III, 216.
Leclercq, B., III, 304.
L'Ecluse, C. (de), II, 418.
Le Coq (von), III, 212.
Lecornu, L., II, 287; III, 146.
Le Dantec, F., II, 217, 466; III, 122.
Le Double, A. F., II, 266, 269.
Leduc, S., II, 461.
Lee, J., II, 291.
Leemans, C., III, 216, 431.
Leener, G. (de), III, 497.
Lees, C. H., III, 61.
Leeuwenhoek, II, 228, 271; III, 27.
Leffingwell, Georgia W., III, 318.
Lefroy, M., II, 459.
Legendre, A. M., III, 414, 438.
Legge, F., III, 149.
Legge, J., III, 214.
Legnano, G. (da), III, 100.
Legrand, L., III, 88, 484.
Legrand, N., II, 466.
Lehmann, E., III, 114.
Lehmann, O., II, 289.
Lehmann, P., III, 354.
Lehmer, D. N., III, 141.
Lehugeur, III, 199.
Leib, K., II, 265.
Leibnitz, G. W. (von), II, 42, 65, 80, 81, 106-124, 228, 270, 271, 358, 420, 424; III, 25, 32, 33, 46, 109-111, 284 sq., 289, 312, 335-339, 462.
Leiden, (van der), II, 56.
Le Lièvre, J., II, 263.
Lémeray, E. M., III, 146.
Lemme, L., II, 442.
Lemmonier, H., III, 104, 114.
Lemoine, A., II, 78; III, 32, 46.
Lemoine, J., II, 156.
Lemoisne, P. A., II, 437.
Le Mort, J., III, 23.
Le Morvan, C., II, 455.
Lemos, M., II, 145.
Lemos, N., III, 32.
Lemprières, II, 273.
Lenné, *Dr*, II, 433.
Leonard, *Saint*, II, 308.
Leonardi, E., II, 440.
Leonardo *Pisano*, II, 258; III, 60, 92, 396, 411, 456.
Leon Ki, III, 98.
Le Petit, J., II, 467.

Le Play, F., II, 278.
Le Pontonnel, II, 476.
Leprins, R., II, 374.
Leroux, E., II, 140 sq.; III, 361.
Leroux, G., II, 429, 431; III, 135.
Leroy, G., II, 82, 83.
Leroy, M., II, 470.
Lesley, J. P., II, 374.
Le Sourd, Jean, II, 438.
Lespieau, R., III, 426-428, 466, 485.
Lesseps, F. (de), II, 463.
Le Strange, G., III, 99.
Letts, E. A., II, 289; III, 443, 485.
Leuba, J. H., II, 101, 308; III, 150.
Leupol, L., III, 184.
Leupold, III, 340.
Leupp, F. E., III, 118.
Le Verrier, II, 424.
Lévi, S., III, 189, 194, 199, 204, 209, 210, 212-214.
Levi-Civita, T., III, 343.
Levy, R., III, 97, 100.
Lewis, W. C. Mc C., III, 486.
Leybourn, W., III, 335.
L'Hospital, *le marquis de*, II, 115, 444.
Liang, Y. K., III, 131.
Liang T'ung-shu, III, 130.
Liard, L., II, 39, 40, 45.
Libavius, II, 323; III, 26.
Libby, W., III, 151.
Libert, L., II, 298, 479.
Libri, G., III, 118.
Lichtenberg, G. C., II, 445; III, 113, 463.
Lichtenberg, R. (von), II, 474.
Lidforss, III, 295.
Lieb, J. W., III, 104.
Lieben, A., II, 280.
Liebig, II, 53, 460; III, 440, 442.
Liebmann, H., II, 453.
Liesegang, F. P., III, 333.
Liesegang, R. E., II, 292.
Liétard, A., III, 215.
Leupold, III, 338.
Lie-tse, II, 437.
Lietzmann, I., II, 250.
Lieutaud, II, 60.
Lilienthal, K. W. O., II, 398; III, 466.
Lillie, F. R., III, 127.
Lillie, R. S., II, 461; III, 492.
Limbosch, P. (van), II, 271.
Lincoln, A., II, 448.
Linden, H. (van der), II, 437.
Lindner, B., III, 189.
Lindsay, W. M., III, 136.
Lingner, K. A., II, 480.
Linnæus, C., II, 228, 272, 446.
Lint, J. G., III, 491.
Liou Ngan, *see* Hoai Nan Tze.
Li Ping, III, 93.
Lippmann, E. O. (von), II, 92, 255, 263, 289, 433; III, 95, 302-305, 320, 321, 323, 325, 333, 342, 352, 354, 366, 454, 485.
Lisboa, J. (de), III, 424.
L'Isle, Romé (de), III, 455.
Lissajous, II, 119.
Lister, *Lord*, II, 166; III, 122.
Lister, M., II, 369.
Lister, R., II, 79.
Little, A. G., II, 164; III, 98, 280-282, 456.
Littmann, E., II, 259; III, 476.
Livens, G. H., III, 147.
Livingstone, D., II, 280.
Lloyd, R. E., III, 128, 324.
Lobachevski, N., III, 344, 367.
Locke, J., II, 228, 271; III, 110, 289.
Lockemann, G., II, 293.

Lockyer, *Sir* N., III, 60 sq.
Locustus, II, 256.
Locy, W. A., III, 127, 154, 497.
Lodovqico *il Moro*, III, 102.
Loeb, J., II, 232, 461; III, 128, 152, 484.
Loew, E. A., III, 479.
Löffler, E., III, 490.
Logan, J. R., III, 216.
Logan, *Sir* W. E II, 373, 376.
Loiseau-Rousseau, II, 163.
Loisy, A., II, 308; III, 94.
Lomazzo, III, 457.
Lombard, P., III, 39.
Lombardo-Radice, G., II, 399; III, 486.
Lönnberg, E., II, 446.
Loomis, Louise R., III, 150.
Lo Parco, F., II, 263.
Lopareo, III, 96.
Lordat, III, 27, 45.
Lorentz, H. A., II, 181 sq., 194; III, 491.
Loret, V., III, 482.
Loria, G., II, 106, 119, 122, 137 sq., 157, 172, 277, 445; III, 16, 60, 114, 118, 142, 339, 340, 362, 363, 470, 471, 490, 495.
Loria, S., II, 457.
Lorin, H., II, 478.
Losacco, II, 309.
Losskij, N., II, 284.
Lotze, III, 440, 484.
Louffenberg, H., III, 329.
Louis XII, II, 266.
Louis XIV, II, 308.
Louys, P., II, 305.
Love, A. E. H., II, 181.
Lowell, A. L., II, 470.
Löwenheim, L., III, 91.
Lower, R., II, 55, 59-61; III, 28, 340.
Lowie, R. H., III, 486.
Lowry, T. M., III, 129.
Lübker, F., II, 431.
Lucas- Championnière, II, 303.
Lucien-Graux, III, 131.
Lucretius, III, 42 sq.
Lüders, H., III, 180, 199, 203, 212.
Ludwig, A., III, 187, 198.
Ludwig, C. S., III, 45.
Luigi, D., III, 331.
Lukasiewicz, J., II, 286.
Lull, Ramōn, III, 25.
Lull, R. S., III, 116, 128.
Lunde, A. (van der), II, 57.
Lunet de Lajonquière, E., III, 216.
Lunn, A., II, 462.
Lusitanus, A., III, 36.
Luther, M., II, 440.
Luton, A., II, 280.
Lüttge, W., III, 209.
Lyall, *Sir* A., III, 205.
Lyell, *Sir* C., II, 363.
Lyman, B. S., II, 373.
Lyon, D. G., II, 308.
Lyon, G., II, 40.
Lythgoe, A. M., III, 350.

M

Maar, V., II, 151.
Maass, E., II, 277.
Mabilleau, III, 22, 42.
Mc Cabe, J., III, 150.
Mc Clymont, J. R., III, 101.
Mac Coll, D. S., II, 476.
Mc Crindle, J. W., III, 208.
Mc Culloch, C. C., III, 101.
Mac Culloch, J., II, 372.
Macdonald, G., III, 124.
Macdonell, A. A., III, 84-87, 182-184, 188, 201, 473.

Macdonnell, W. R., II, 256.
Mac Dougal, D. T., II, 461.
Mc Dowell, E., II, 278.
Macfarlane, A., III, 291, 466.
Mac Gill, Caroline E., III, 359.
Mach, E., II, 283, 447; III, 122, 277, 312, 369.
Mackenzie, D., III, 360.
Mackenzie, W., II, 300.
Mackinnon, D., II, 296.
Maclauren, III, 463.
Maclaurin, C., III, 289 sq., 464.
Mc Clenon, R. B., III, 456.
Macleod, J., III, 310.
Maclure, W., II, 371, 372.
Macvail, J. C., II, 298.
Madhava *Acharya*, III, 187, 225.
Maedge, C., II, 471.
Magendie, F., III, 484.
Mager, II, 101.
Magnan, II, 299.
Magnus, H., II, 147.
Magrini, S., II, 222-224, 427 sq.; III, 492.
Magyary-Kossa, J. (von), II, 271.
Mahaffy, J. P., III, 388.
Mahavira *Acharya*, II, 355 sqq., 356.
Mahmud-Bey, III, 477.
Mahncke, D., III, 106.
Maillet, B. (de), II, 358.
Maimon, S., II, 446.
Maimonides, II, 262, 439; III, 97.
Maindron, III, 208.
Mairan, III, 445.
Maisey, F. C., III, 207.
Maitra, Harendranath, III, 138.
Maiwald, II, 273.
Malaguzzi-Valeri, F., III, 102.
Malcolm, W., II, 378.
Mâle, E., III, 97.
Malebranche, N., II, 53, 59, 70, 72, 74, 78, 80, 88; III, 27, 29, 51, 337.
Malhorca, J. (de), III, 426.
Mallik, D. N., III, 147.
Malloch, A., III, 111.
Mallon, E. A., III, 332.
Malpighi, M., II, 60, 61, 228, 269; III, 27, 28.
Mamum, A. al, III, 458.
Manacorda, G., II, 399.
Mancini, G., III, 102.
Mandeville, *Sir* J., III, 100, 327.
Manfredi, H., III, 100, 102.
Manget, II, 55, 71, 87.
Mangin, L., III, 122.
Manilal Nabhubhai Dvivedi, III, 252.
Manilius, III, 94.
Manitius, K., II, 401.
Manley-Bendall,II, 288.
Manouvrier, L., II, 245.
Mansion, A., II, 255.
Mansion, P., II, 133, 255, 277.
Mansur, abu, Muwaffaq ben Ali, III, 300, 302.
Manu, III, 197.
Manziarly, J. (de), III, 192, 194.
Manzo Ajima, III, 113.
Marbach, F., II, 49.
Marcel, *chanoine*, II, 273.
Marcel, G., II, 169.
Marcellus *Empiricus*, III, 321, 436.
Marcet, A., II, 275.
Marcgrave, G., II, 269.
March, L., III, 123.
Marcolongo, R., II, 173, 174-182; III, 143, 483.
Marcon, J., II, 371, 372, 381.
Marcus Græcus, III, 305.
Marcy, O. H., III, 122.

Marett, R. R., II, 308; III, 133, 360.
Margerie, E. (de), II, 357, 379 sqq., 392, 462, 464.
Margoliouth, D. S., II, 258, 259.
Marguet, F., III, 106, 118, 134.
Maria, *alchemist*, III, 303.
Marinus, A., II, 286.
Marinus of Tyre, III, 423.
Marliano, J., III, 41.
Mark, B., II, 266.
Markham, *Sir* C. R., II, 282, 415-418; III, 459.
Markof, II, 395.
Marpillero, G., II, 399.
Marsh, Adam, III, 263, 280 sq.
Marshall, A., III, 130.
Martell, P., III, 466.
Martha, J., II, 477.
Martin, A., (Ambrosius Victor), II, 83.
Martin, Alfred, III, 364.
Martin, C. J., III, 61.
Martin, E. O., III, 139.
Martin, P. F., II, 463.
Martin, T. H., II, 203.
Martine, G., II, 51.
Martines, Joan, III, 107.
Marumatsu, II, 411.
Marvin, F. S., II, 306, 425-427; III, 118, 136, 468.
Marvin, W. T., III, 128.
Marx, A., III, 100.
Marx, C., II, 239.
Marx, C. F. H., II, 73; III, 38.
Marx, F., III, 319.
Marx, J. M., II, 470.
Marzell, H., II, 304.
Masaccio, III, 102.
Masaryk, T. G., II, 238 sq.; III, 145.
Mascart, J., III, 424.
Mascheroni, L., II, 445.
Maspero, *Sir* G., III, 43, 122, 216.
Massa, N., II, 55, 68.
Massalongo, R., III, 457, 459.
Masson, II, 210.
Masson-Oursel, P., II, 309; III, 64-88, 92, 171-218, 472, 473, 479.
Mathews, J. A., III, 118.
Mathias, E., III, 120.
Mathieu, II, 181.
Matignon, C., II, 277, 457.
Matschoss, C., II, 139.
Matsunga Ryôhitsu, II, 15, 20.
Matthaei, O., II, 263, 439.
Mattingly, H., III, 96.
Mattirolo, O., III, 21.
Matula, J., II, 290.
Maudslay, A. P., III, 292, 294.
Mauduit, II, 83.
Maufre, III, 34.
Mauget, III, 25, 31.
Mauguin, C., III, 147.
Maunder, Annie S. D., III, 140.
Maunier, R., II, 253.
Maupertuis, P. L. M. (de), II, 83, 271; III, 29, 47, 440.
Mauristos, III, 434.
Mauss, M., III, 205.
Mavor, J., II, 478.
Maxwell, J. Clerk, II, 181, 194, 223, 427; III, 152, 275, 291.
May, W., II, 461; III, 134, 467.
Maybon, A., II, 436.
Maybon, C. B., III, 216.
Mayer, J. R., II, 169, 282, 447, 449.
Mayerne, T. (de), II, 324.
Mayet, L., II, 473.
Mayow, J., II, 51, 59-62, 79.
Mayura, III, 95.
Mazenta, A., III, 331.

Mead, R., II, 79.
Medicus, F. C., III, 483.
Megasthenes, III, 208.
Megenberg, K. (von), II, 263, 439.
Mehilis, G., II, 309.
Meier, E., III, 199.
Meillet, A., II, 477; III, 182, 212, 488.
Meiners, C., III, 12.
Meira, J. (de), II, 145.
Meissner, B., III, 317, 349.
Meli, R., II, 432.
Melin, G., II, 470.
Mencke-Glückert, E., II, 267.
Mendel, G. J., II, 230 sq., 460.
Mendel, I., II, 267.
Mendeljew, D. I., III, 367.
Menendez y Pelayo, II, 85.
Menjot, A., III, 111.
Mentel, J., II, 55.
Merbach, P. A., III, 342.
Mercator, G., III, 105, 106.
Mercier, C. A., II, 307; III, 144.
Merriam, M., III, 417.
Merrill, F. J. H., II, 374.
Merrill, G. P., II, 369, 378; III, 361.
Merritt, C., III, 340.
Mersenne, *le Père*, II, 85 sq.; III, 51, 55, 334.
Mesnil, J., III, 102.
Messahalah, III, 459.
Messedaglia, L., II, 269, 273.
Messer, A., II, 300.
Metze, E., II, 447.
Metzger, Hélène, III, 445-446, 487.
Meusnier, *Général*, III, 463, 468.
Mewaldt, I., II, 431; III, 319.
Meyer, B. H., III, 359.
Meyer, E. (von), II, 195; III, 333.
Meyer, E. H. F., III, 298.
Meyer, H. B., III, 359, 485.
Meyer, J.-B., II, 72.
Meyer, J. F., II, 78.
Meyer, Kirstine, II, 288.
Meyer, L., II, 281.
Meyer, O. E., II, 281.
Meyer, R., II, 289.
Meyer, U., II, 456.
Meyerhof, M., II, 253; III, 328, 352, 454, 476.
Meyerhoffer, W., II, 280.
Meyersen, III, 25.
Meyer-Steineg, T., II, 204, 255; III, 94, 348.
Miall, B., II, 463.
Michael, R., II, 392.
Michel, A., II, 268.
Michelotti, II, 64, 65; III, 30.
Michels, R., II, 470.
Middleton, Richard (de), III, 39.
Mieli, A., II, 90-99, 155, 206-208, 245-247, 265, 276, 399, 427 sq., 442, 458; III, 59 sq., 102, 106, 111, 114, 118, 130, 135, 151, 331, 339, 367, 466, 471, 486, 493, 494, 495.
Migeon, G., II, 260, 434; III, 218.
Mikami, Yoshio, II, 9-36, 261, 356, 410-413; III, 111, 141, 470, 479.
Milbourn, III, 335.
Milcamps, E., II, 280.
Mildbread, J., II, 303.
Milford, H., II, 268.
Milhaud, G., III, 111, 112, 277, 391-395, 461, 494.
Mill, J. S., II, 279, 447.
Millardet, III, 295.
Miller, A. W., III, 147.
Miller, G. A., III, 142, 143, 367, 465, 491.
Miller, G. H., III, 490.
Millet, J. B., III, 45.

Milligan, E., III, 319.
Milloué, L. (de), III, 211.
Milne, J. S., II, 255.
Milton, II, 399.
Mimms, S. L., II, 447.
Minayeff, J., III, 185, 193.
Minchin, G. M., III, 122.
Minkowski, H., II, 181; III, 146.
Minnigerode, W., II, 465.
Minto, W., III, 12.
Mirande, D., II, 251.
Mirza Muhammed Haidar Dughlat, III, 218.
Mitford, E. B., III, 140.
Mitscherlich, III, 427, 435.
Miyagi Seiko, II, 24.
Moberg, A., III, 176.
Moberg, K. A., II, 377.
Moch, G., II, 470.
Mœller, G. H., II, 277.
Moetefindt, H., III, 366.
Moteti, G., III, 60, 105.
Molhuysen, P. C., III, 127.
Moll, F., III, 352.
Möller, G., II, 253.
Molk, J., III, 122.
Monardis, N., III, 332.
Moncalieri, A. (di), II, 263; III, 100.
Monceaux, P., III, 94.
Monckton-Jones, M. E., III, 204.
Monconys, B. (de), III, 371.
Mondeville, H. (de), III, 37, 329.
Monge, III, 471.
Monier-Williams, *Sir* M., III, 184, 196.
Monnet, II, 370.
Monnier, H., II, 256.
Montagu, G., II, 276.
Montagu-Nathan, M., II, 477.
Montaigne, II, 80, 81.
Monte, G. (del), II, 267.
Montecatini, W. (da), II, 263; III, 99.
Montesquieu, II, 198, 473.
Montessori, II, 477.
Montessus de Ballore, R. (de), III, 359.
Montfort, III, 47.
Montgomery, E., III, 440.
Moodie, R. L., III, 148, 149.
Moon, R. O., II, 255.
Mooney, J. J., III, 453.
Moor, B. (de), III, 34.
Moore, G. F., II, 308; III, 367, 493.
Moore, N., II, 296.
More, L. T., II, 454.
Moreau, H. G., II, 217.
Moreau, J., III, 122.
Moreau de Saint-Méry, M. L. E., II, 447.
Moret, A., II, 253; III, 122, 471.
Moreux, T., III, 125.
Morgagni, G. B., II, 213; III, 114, 340.
Morgan, E., III, 340.
Morgan, M. H., III, 93.
Morgan, T. H., III, 128, 357.
Morgan, W. S., II, 471.
Morgenstern, A., III, 325.
Morgenstern, K., III, 113.
Morin, F., II, 63, 85; III, 42.
Morison, R., II, 271; III, 340.
Moritz, R. E., II, 453; III, 142, 362, 462.
Morley, D. (de), See Daniel.
Morley, F. V., III, 333.
Morley, S. G., III, 134, 292-294, 481.
Mornet, D., II, 212, 274.
Morrice, G. G., II, 286.
Morrice, J. C., III, 112.
Morris, M., III, 327.

Morris, W., II, 400.
Morse, E. L., III, 118.
Morse, S. F. B., III, 118.
Mortet, V., III, 397.
Morton, W. T. G., III, 119, 446.
Morveau, G. (de), II, 169.
Moses, *alchemist*, III, 303.
Mosso, A., II, 398; III, 467.
Motefindt, H. III, 497.
Moule, A. C., III, 98.
Moulé, L., II, 257.
Moureu, C., III, 358.
Mourgue, R., III, 118.
Mouton, H., II, 461; III, 147.
Moye, M., II, 288.
Mozans, H. J., II, 301.
Muhammed, II, 240.
Muhammed, Abu, Abd Allah ibn Qasim ibn Abd Allah Jahja al Siqili, III, 478.
Muhammed, abu, Mustapham, II, 415.
Muhammed b. Musa, el-Chowarizmi, II, 353-356; III, 96 sq., 263, 269, 353, 396, 413, 454, 477.
Mu'in ud-Din, II, 413.
Muir, J., III, 180, 205.
Muir, *Sir* W., III, 352.
Mukhopadhyaya, Girindranath, III, 473.
Mullens, W. H., III, 371.
Müller, Adolf, III, 110.
Müller, Aug., III, 176.
Müller, C., III, 422.
Müller, E., II, 285, 432.
Müller, Félix, II, 130, 285.
Müller, Franz J., III, 438, 464, 466, 483.
Müller, Friedrich, III, 346.
Müller, F. Max, III, 177, 180, 182, 183, 187, 190, 191, 252.
Müller, J., III, 176.
Müller, Johannes, II, 279; III, 28, 345, 371, 440, 484.
Müller, J. W. K., III, 212.
Muller, P., II, 256.
Müller-Reinhard, J., III, 105.
Mulon, P., II, 295.
Mummendorff, III, 463.
Mundy, P., II, 443.
Munoz, A., III, 60.
Müntz, V., III, 38.
Murad, F., III, 176.
Murchison, R., II, 365, 372, 380.
Murdoch, P., III, 115.
Muristos, III, 479.
Murray, G., III, 5, 136, 137.
Murray, J., II, 387, 402 sq.; III, [474.
Mzik, H. (von), III, 217.

N

Nabarawi, III, 352.
Näcke, P., II, 300.
Nagarjuna, III, 69.
Nagi, III, 396.
Nakane Genjun, II, 412.
Nallino, C. A., III, 459, 477.
Napier, J., II, 166 sq., 442; III, 110, 111, 141, 285 sq., 334, 336, 338 sq., 460, 461, 462.
Napoléon I, II, 275, 276.
Nardecchia, A., III, 59 sq.
Nassir Eddin al Tusi, II, 414.
Naudé, G., II, 419.
Naudin, C., III, 295, 345.
Navarro, L. F., III, 135.
Naville, E., II, 258, 430.
Nearchos, III, 208.
Neckam, Alexander, II, 262; III, 263.
Needham, II, 62, 209-213; III, 113, 440.

Nemorarius, J., II, 262; III, 396.
Neogi, P., III, 122.
Nernst, W., II, 194, 457.
Nesfield, C., III, 177.
Netolitzky, F., III, 350.
Neuburger, M., II, 147, 153, 278, 280, 296; III, 333, 345, 346.
Neufeld, M. W., III, 369.
Neugebauer, P. V., III, 91.
Neumann, F., III, 333.
Neurath, O., III, 147.
Neustätter, O., II, 296.
Neuwirth, J., III, 346.
Nève, F., III, 200.
Neveu, R., II, 296.
Newbigin, Marion I., III, 121.
Newcomb, S., II, 413; III, 417.
Newell, E. T., III, 92.
Newman, E., II, 449.
Newton, *Sir* I., II, 79, 112, 115, 209, 223, 270, 271, 283, 424, 444; III, 109, 111, 282-290, 338, 340, 460, 461.
Nias, J. B., III, 462.
Niceforo, A., III, 369.
Nicephoros, III, 304.
Nichiren, III, 98.
Nicholas *of Poland*, III, 327.
Nicholls, F., III, 45.
Nichols, F. M., III, 105.
Nichols, H. W., III, 131.
Nicholson, R. A., II, 258.
Nicol, J., II, 380.
Nicolai, C., II, 270.
Nicolas, C., II, 304.
Nicollaud, C., II, 441.
Nicomachus, II, 354.
Niebuhr, K., II, 428.
Niedermann, M., III, 321.
Nielsen, N., II, 285.
Niemann, W., III, 342, 344, 360, 371, 466, 485.
Nietzsche, F., II, 448; III, 311.
Nieuwentut, II, 122.
Nieuwenhuis, A. W., II, 146.
Nezahualcoyotl, II, 440.
Nias, J. B., II, 269.
Nicaise, II, 73.
Nightingale, Florence, II, 281, 450; III, 122.
Nimal, H. (de), II, 291.
Nippoldt, A., III, 492.
Nivedita, *Sister*, III, 122, 139.
Nixon, J. A., II, 263.
Nizami, III, 475.
Nobili, III, 439.
Noble, Margaret E., *see* Nivedita, *Sister*.
Noël, E., II, 307.
Noguchi, Yone, II, 437; III, 139.
Nolen, III, 32.
Noll, A., III, 483.
Norden, E., II, 431.
Nordenskjold, O., II, 293.
Norlund, N. E., III, 119.
Nörregaard, K., II, 280.
Norrenberg, J., II, 283.
North, S. N. D., III, 347.
Northrop, III, 484.
Northup, G. F., III, 108.
Nostradamus, M., II, 441.
Nunez, P., III, 106, 424.
Nützel, H., III, 176.
Nuwairi, al, II, 259; III, 352.
Nyayalankara, III, 196.
Nyayaratna, III, 187.
Nys, E., II, 419.

O

Oakes, *Sir* A., III, 118.
Obermaier, H., II, 234-237; III, 149.
Obicius, H., III, 36.

Ocagne, M. (d'), II, 443, 453; III, 117.
Ockham, William, III, 39, 280.
O'Creat, N., III, 396, 409.
Oderic, *of Pordenone*, II, 261; III, 100.
Odling, III, 428.
O'Donnell, Manus, III, 480.
O'Donoghue, F., III, 137.
Oefele, F. (von), II, 466, 474.
Oersted, H. C., II, 456; III, 275, 276.
Oettingen, A. (von), II, 270.
Oganesow, L. A., II, 466.
Ogawa Kôkei, II, 36.
Ogden C. K., III, 439, 483.
Ohm, M., II, 280; III, 417.
Okakura, Kakuzo, III, 122.
O'Kellcher, A., III, 480.
Oken, III, 440.
Olbers, W., II, 278.
Olbers Focke, W., II, 278.
Oldenberg, H., III, 187-190, 194, 201, 204.
Oldenburg, S. (d'), III, 178.
Oliver, J. E., III, 417.
Olivier, E., II, 297.
Olivier, L., III, 270.
Oliviera Martins, J. P., III, 102.
Ollion, H., II, 271; III, 55.
Olney, E., III, 416.
Oltramare, P., III, 190, 191.
Olympiodorus, III, 278, 304.
Olympiodorus, *the younger*, III, 304.
Omar b. Ibrahim, el-Chaijami, II, 355.
Omont, H., III, 218.
Onnes, K., II, 194.
Oppenheimer, C., III, 492.
Oppert, G., II, 199; III, 178.
Oppian, II, 254.
Orbigny, A. (d'), II, 372; III, 361.
Oresme, N., II, 421; III, 40, 100, 142.
Oriani, B., II, 276; III, 438.
Oribasius, III, 435.
Ornstein,, Marthe, II, 269.
Orr, Mary, A., II, 440; III, 99.
Orta, G. (da), II, 415-418; III, 425-459.
Ortelius, A., II, 441.
Ortroy, F. (van), II, 441.
Osborn, H. F., II, 436; III, 118, 128, 149.
Osler, *Sir* W., II, 57; III, 106, 112, 119, 342, 346, 488.
Osman, *eff.*, II, 258.
Ostanes, III, 303-305.
Osterhausen, II, 152.
Ostwald, W., II, 91, 153, 221 sq., 281, 290, 309, 423 sq., 448, 458, 469; III, 119, 122, 468.
Otlet, P., II, 471; III, 150, 420, 421.
Oughtred, W., III, 109, 282 sq., 335, 336, 460, 462.
Ou-K'ong, III, 214.
Ovio, G., III, 318.
Owen, A. S., III, 94.
Owen, R., II, 447.
Owen, W. O., III, 114.
Owens, J. G., III, 292.
Oye, P. (van), II, 169.

P

Pacchioni, A., II, 444.
Pacheu, J., II, 440.
Pacinotti, A., II, 280.
Pacioli, *Fra* L., III, 102.
Packard, A. S., II, 216.
Packard, F. R., III, 143.
Packe, C., II, 370.

Padoa, A., II, 286.
Page, L., III, 116.
Pagel, J. (von), II, 148.
Pahl, F., II, 283.
Palasson, P. B., II, 371.
Palatini, A., III, 491.
Pallas, P. S., II, 277, 364.
Palmer, E., III, 185.
Pammenes, III, 303.
Pancritius, Marie, III, 349.
Panini, III, 183.
Paolo *Veneto*, III, 40 sq.
Papillon, III, 23, 24, 27, 32.
Papini, G., II, 245-247; III, 146.
Pappos, III, 304.
Paracelsus, II, 42, 228, 266, 323 sq., 441, 442; III, 23, 25, 26, [107.
Paramartha, III, 191, 213.
Parasnis, D. B., III, 203.
Pardi, G., III, 455.
Pardies, *le Père*, II, 83.
Paré, A., II, 68, 266; III, 106, 332.
Parisanus, II, 52.
Parisot, E., III, 389.
Parker, E. H., III, 131.
Parker, G., II, 297.
Parker, H., III, 204.
Parker, Margaret, II, 208.
Parker, Ma'thew, II, 208.
Parkin, T., II, 280.
Parkyn, E. A., III, 149.
Parmenides, III, 15, 91, 317.
Parmentier, A. A., II, 275, 276.
Parmentier, G., II, 293.
Parmentier, H., III, 216.
Parmentier, L., II, 289.
Parona, C. F., II, 392, 394.
Parsons, C. A., III, 344.
Parsons, Elsie C., III, 134.
Pascal, A., II, 445.
Pascal, B., II, 80, 115, 268, 269, 424, 443; III, 28, 337, 340.
Pascal, C., II, 431.
Pascal, E., III, 416.
Pascal, J., 65, 78; III, 22 sq.
Pascoli, A., II, 79.
Passanha, M., III, 426.
Pasteau, O., II, 467.
Pasteur, L., II, 169, 424, 460; III, 428.
Pasteur, M^me^, II, 449.
Pastor, Rey, III, 491.
Patanjali, III, 192.
Paternô, E., II, 280.
Patesis, III, 349.
Patin, C., II, 56.
Patin, G., II, 52; III, 26, 109.
Paton, D., III, 91.
Paton, Lucy A., III, 347.
Patrick, G. T. W., II, 468.
Paulhan, F., II, 104.
Pauli, S., II, 55.
Paulisa, II, 332, 333, 349.
Paulus *Aegineta*, III, 348, 436.
Pauly, J. de, III, 88.
Pausanias, III, 320.
Pavie, A., III, 216.
Pavlov, II, 468.
Pax, *D^r^*, III, 114.
Payen, II, 53, 54.
Peacock, G., III, 291.
Peano, G., II, 178, 182; III, 312, 491.
Pearson, K., III, 295.
Pecchio, G., II, 470.
Pechlin, N., II, 59.
Peckham, John, III, 263, 280 sq.
Pecquet, II, 54, 55, 57.
Peiper, II, 304.
Peirce, C. S., III, 417.
Peiseneer, P., III, 467.
Peiresc, Fabri de, II, 53-55; III, 35.
Pelacani, B., III, 40 sq.

Péladan, III, 38.
Pélagaud, F., III, 482.
Pelagios, III, 304.
Peligk, III, 334.
Pellechet, Marie, II, 264.
Pelliot, P., II, 436; III, 96, 212, 214, 471.
Pemberton, III, 31.
Pensuti, V., II, 155, 251, 429.
Pereira, G., II, 85.
Pereire, A., II, 278.
Pérez, J. A. S., III, 97.
Perkin, W. H., III, 344.
Perrault, C., II, 70, 78; III, 29, 45.
Perrier, *Captain*, II, 163.
Perrier, E., II, 217, 229, 294, 447, 461.
Perrier, F., III, 468.
Perrier, T., III, 36.
Perrin, J., II, 194-197.
Perrotin, H., II, 288.
Perry, W. J., III, 149.
Persons, W. M., III, 486.
Pesci, G., II, 286.
Pétéisis, II, 430.
Petermann, A., II, 373.
Peters, C. H. F., II, 401, 414; III, 94, 453.
Peters, H., II, 266; III, 462.
Peterson, III, 177.
Petesis, III, 303.
Petit, A. T., III, 427.
Petrarca, II, 263; III, 99, 100.
Petrie, W. M. Flinders, II, 252, 253, 430; III, 124, 134, 314 sq., 469, 470, 497.
Petronievics, B., II, 278; III, 367.
Petrucci, R., III, 130, 471.
Petrus de Dacia, III, 397.
Pettersson, O., II, 463.
Petzoldt, J., II, 309, 454.
Peutinger, K., II, 265.
Peyer, J. C., II, 60.
Peypers, H. F. A., II, 146.
Philip, A., II, 288.
Philip, J. C., III, 61.
Philipon, E., II, 307.
Philipp, K., III, 456.
Philippe, A., II, 467.
Philippe, J., III, 42.
Philips, W. R., III, 209.
Phillott, D., III, 185.
Philo, III, 478.
Philoponus, J., III, 278.
Philosophus Christianus, III, 304.
Pibechios, III, 304.
Picard, E., II, 134; III, 117, 119, 121, 152.
Picart, L., II, 288.
Picavet, F., II, 164, 217; III, 480.
Picca, P., II, 255, 266, 297.
Pichon, S., II, 436.
Piéron, H., II, 300.
Piette, E., III, 366.
Pigaffetta, A., II, 169; III, 104 426.
Pigli, C., III, 367.
Pigouchet, III, 108.
Pillet, M. L., II, 433 sq.
Pillion, Louise, II, 439.
Pillon, II, 83.
Pincott, F., III, 200.
Pinel, II, 299.
Pinelli, G. V., III, 459.
Pinto, III, 27.
Piper, O., II, 302.
Pirro, A., III, 35.
Pirsson, L. V., III, 116.
Pischel, R., 185, 188, 194, 201, 212.
Piso *of Leyden*, III, 332.
Pitcairn, II, 60, 65; III, 25, 32.

Pizetti, P., III, 439.
Placitus Papyrensis, S., III, 436.
Plan, P. P., III, 443.
Planck, M., II, 194.
Plate, L., II, 292.
Plateau, J., II, 120.
Plater, F., II, 267.
Platner, E., II, 77.
Plato, II, 203 sq., 228, 256, 262; III, 7, 10, 42, 91, 92, 135, 266, 267, 317, 318, 452.
Playfair, J., II, 362.
Plehn, F., II, 281.
Plemp, V. F., II, 53, 54, 59; III, 35.
Pleyte, C. M., III, 216.
Pliny, *the elder*, II, 202 sq., 228, 254; III, 92, 318, 357, 497.
Plotinus, II, 69; III, 95.
Plotnikow, J., III, 486.
Plutarch, III, 208.
Poche, F., II, 295.
Poggendorf, J. C., III, 22, 29, 34.
Pohl, R., II, 457.
Pöhlmann, R. (von), II, 432.
Poincaré, H., II, 192, 197, 398, 451; III, 117, 119, 312, 343, 465.
Poinsot, II, 181.
Poisseville, III, 28.
Poisson, *le Père*, II, 83; III, 55.
Poisson, S. D., II, 223, 427.
Polhem, C., III, 462.
Polimanti, O., II, 280.
Pollard, A. F., III, 268.
Pollard, A. W., II, 440.
Pollitzer, A., II, 282.
Pollock, H. M., II, 471.
Polo, Marco, III, 218.
Pomel, II, 374.
Pomet, P., II, 268.
Pomme, P., II, 273.
Pompignan, A. (de), III, 193.
Pomponazzi, P., III, 41.
Pontsevrez, T., II, 463.
Pope, *Sir* W., III, 358.
Popenoe, P., III, 357.
Poppi, A., II, 71.
Porta, J. B., II, 88; III, 26, 333.
Portal, A., II, 447.
Portigliotti, G., II, 266.
Posewitz, T., II, 293.
Poske, F., II, 268.
Posner, C., II, 304.
Pottier, II, 100, 104 sq.
Pouchet, G., III, 48.
Poussier, A., II, 262.
Pousson, A., II, 466.
Pousson, A., II, 466.
Pouyanne, II, 374.
Powell, E., III, 99.
Powell, J. W., II, 377.
Power, *Sir D'A*, II, 263; III, 340.
Power, Maura, III, 459.
Poynting, J. H., III, 122.
Praçastapada, III, 238, 247, 250.
Prain, D., III, 121.
Prantl, C., III, 112.
Prashad, B., III, 371.
Pratt, J. B., III, 139.
Prezzolini, G., II, 246.
Priestley, J., II, 169; III, 342.
Prieur, A., II, 146 sq.
Prilleux, E. E., III, 122.
Primirose, II, 52 sqq., 59.
Pringsheim, P., II, 457.
Printz, W., III, 172, 182.
Priscianus, Theodorus, II, 205.
Probst, O., III, 321.
Probsthain, II, 260.
Prochaska, G., III, 483.
Proclus, II, 256; III, 351.
Procopius, III, 321.
Procter, R., II, 264.

Proskauer, C., II, 151, 297.
Prouhet, II, 133.
Prout, W., II, 279.
Pruefer, C., III, 454.
Pruvost, R., III, 361.
Przyluski, J., III, 131.
Psellos, III, 304.
Pseudo-Apuleius, III, 436.
Pseudo-Aristotle, II, 164.
Pseudo-Avicenna, III, 305.
Pseudo-Democritus, III, 303, 304, 323.
Pseudo-Dioscorides, III, 436.
Pseudo-Galen, III, 351.
Pseudo-Geber, II, 324; III, 305.
Pseudo-Razi, III, 305.
Ptolemy, II, 204, 333, 347, 354, 401, 414; III, 93, 94, 102, 208, 209, 263, 268, 422 sq., 453.
Pucci, III, 439.
Puccinotti, F., III, 28, 30, 323, [367.
Puissant, III, 438.
Pulisa, III, 434.
Purkinje, J. E., II, 280.
Puschmann, T., II, 148.
Pythagoras, II, 255, 256, 285; III, 82, 312.

Q

Qosta b. Luka, el-Baalbeki, II, 354.
Quackenbos, G. P., III, 95.
Quatrefages, A. (de), II, 199, 217.
Quattrami, E., III, 332.
Quattromani, S., II, 207.
Quételet, L. A. J., III, 295.
Quincey, J. W., II, 437.

R

Rabélais, II, 266; III, 107, 459.
Rabier, E., II, 39, 76, 82.
Rabiqueau, C., III, 371.
Rabut, C., III, 153.
Radcliffe, J., III, 462.
Radhakumud Mookerji, III, 92.
Radl, E., II, 213-216, 217, 224-229, 465; III, 22, 24, 25, 27, 128, 357.
Radulph of Laon, III, 398.
Raffi, A., II, 435.
Rahir, E., II, 302.
Rajendralala Mitra, III, 189-191.
Rama Narayana Vidyaratna, II, 407.
Ramanujacharia, III, 205.
Rama Prasada, III, 192.
Ramazzini, III, 30.
Rambaud, P., II, 268.
Ramsay, *Sir* A. C., II, 373.
Ramsay, *Sir* W., II, 458; III, 119, 122.
Rangachari, K., III, 204.
Rangacharya, M., II, 356; III, 177.
Rankine, W. J. M., III, 291.
Ranking, G., III, 185.
Ranking, G. S. A., II, 258.
Ranson, J. V., III, 466.
Raoult, III, 427.
Rapson, E. J., III, 83, 139, 202, 203, 474.
Rath, E., III, 102.
Ratner, III, 353.
Ravarit, G., II, 278.
Ravenel, H. W., III, 345.
Rawlinson, H. G., III, 139, 209.
Ray, J., II, 447.
Ray, M. B., II, 302.
Ray, P. C., II, 322-324; III, 68 sqq., 206, 305, 474.
Rayleigh, *Lord*, II, 166, 194.
Raymond, P., II, 274.

Réau, L., II, 477.
Réaumur, II, 65, 212, 228.
Reber, B., II, 274, 278, 446.
Reclus, O., II, 463.
Recorde, R., III, 333.
Reeves, E. A., II, 380; III, 135.
Redi, F., II, 212, 228; III, 334.
Regelsperger, G., III, 121.
Reggio, Niccoló (da), II, 263.
Régis, II, 65, 72; III, 50.
Regius, II, 53, 59; III, 55.
Regius, Henricus, (Hendrick de Roy), III, 460.
Régly, *l'abbé*, II, 210.
Regnaud, P., III, 182, 189, 190.
Regnault, F., II, 266, 308, 430, 432; III, 318, 331, 333, 350.
Regnault, H. V., II, 282.
Regnault, J., II, 307.
Rehm, A., II, 255.
Reid, T., III, 289.
Reil, J. C., II, 278, 446; III, 440,
Reil, T., II, 430. [483.
Reinach, A., II, 253, 254, 431; III, 135.
Reinach, S., II, 302.
Reinach, T., II, 431; III, 135.
Reinaud, J. T., III, 217.
Reindl, J., II, 291.
Reinelt, P., II, 273.
Reinesius, III, 26.
Reinhard, F., III, 350.
Reinheimer, H., II, 301.
Reisch, G., III, 353.
Reischauer, A. K., III, 141, 215.
Reismüller, G., II, 436.
Reitzenstein, R., III, 303.
Rémusat, C. (de), II, 42.
Renan, E., II, 199, 449.
Renaudet, A., II, 265.
Renaudot, T., II, 49, 68, 88; III, 22, 26, 36.
Renaut, J., II, 438.
Renneville, R. A. C. (de), III, 218.
Renouvier, III, 58.
Renzi, S. (de), III, 367.
Rescher, O., III, 476.
Retines, Robert (de), *see* Robert *of Chester*.
Reuter, O. M., II, 295.
Reutter, J., II, 299.
Reutter, L., II, 251, 253.
Revault d'Allonnes, G., II, 217.
Reverchon, L., III, 112.
Révész, B., III, 367.
Révillout, II, 199.
Rey, A., II, 310.
Rey, J., II, 266.
Rey, Jean, II, 169; III, 339.
Reymond, A., II, 255, 410-413; III, 479.
Reynier, J., III, 361.
Reynolds, J. H., III, 61.
Reynolds, W. E., III, 102.
Rhazes, II, 258.
Rheticus, G. J., II, 205.
Rhind, A. H., II, 253.
Rhodes, G., II, 300.
Rhousopoulos, O. A., III, 358.
Ribeiro, C., II, 373, 377.
Ricci, S. (de), II, 400; III, 102.
Riccioli, II, 206.
Richard, G., II, 449.
Richard, T., II, 260.
Richards, *Sir* E., III, 118.
Richards, R., III, 132.
Richardson, E. C., III, 127.
Richardson, G. H., II, 431, 475.
Richardson, H. K., III, 93.
Richardson, L. J., III, 469.
Richardson, O. W., III, 147.
Richelot, II, 297.
Richer, III, 398.

Richer, P., II, 269.
Richet, C., II, 56, 57, 74, 292; III, 25, 357.
Richter, C., II, 217.
Richter, J. P., III, 37.
Richter, P., II, 256, 258, 266, 297.
Richthofen, F. (von), II, 374, 375.
Ridgeway, W., III, 136.
Ried, H. A., II, 304.
Riepl, W., II, 256.
Riesman, D., III, 365.
Riesz, M., II, 284.
Rigaud, S. P., III, 285.
Rignano, E., II, 300; III, 153.
Rimini, G. (de), III, 40.
Riolan, J., *fils*, II, 43, 52, 73, 75.
Risley, *Sir* H. H., II, 409.
Rist, C., III, 132.
Ritter, H., III, 476.
Ritti, A., II, 468.
Ritz, II, 456.
Rivaud, A., II, 270.
Rivers, W. H. R., II, 304, 471.
Rivet, P., II, 303.
Rivière, E., II, 478.
Rivière, H., II, 434.
Rivière, M^me^ M. J., III, 342.
Rivoira, G. T., II, 434.
Robb, A. A., III, 146.
Robbins, W. W., III, 134.
Robert *of Chester*, III, 263, 269.
Roberts, H. F., III, 129, 345.
Robertson, D. S., II, 205.
Robertson, J. M., II, 450.
Roberval, III, 50.
Robespierre, II, 272.
Robin, A., II, 394.
Robin, L., III, 318.
Robinet, II, 87.
Robinson, C. H., III, 150.
Robinson, H. H., II, 375.
Robinson, J. H., III, 100, 137.
Robinson, Lydia G., II, 284, 445; III, 324.
Robinson, N., III, 31.
Roblot-Delondre, Louise, II, 441.
Rocchi, V., III, 28.
Rochas (de), III, 51.
Roché, H., II, 446.
Rochet, III, 46.
Rochmonteix, *le Père* C. (de), II, 42.
Röck, H., II, 255.
Rockhill, W. W., II, 436; III, 123.
Rodestock, Henricus (de), III, 328.
Rodet, L., II, 355, 356.
Rodier, II, 67.
Rodocanachi, E., II, 266, 274.
Roe, J. W., III, 153.
Roemer, O., II, 270.
Roer, E., II, 407; III, 187.
Roger, G. H., II, 466.
Rogers, A., III, 203.
Rogers, J., II, 65.
Rogers, J. F., III, 106.
Rogers, R. W., III, 126.
Rohault, J., II, 50, 59, 62, 63, 72, 74, 78; III, 110.
Rohlfs, G., II, 143 sq.
Rohlfs, H., II, 143 sq.
Rohner, A., II, 262.
Rohr, M. (von), III, 344.
Rolfe, H. W., III, 100.
Rolfink, W., II, 54.
Roller, K., II, 269.
Romagnosi, G. B., II, 276.
Romanes, G. J., II, 217.
Romeyn, D., II, 278.
Roos, II, 280.
Roose, T. G. A., III, 483.
Röntgen, W. C., III, 466.

Rorarius, II, 81.
Roscher, W., II, 432.
Rose, V., III, 268.
Rosen, F., II, 356.
Rosen, V., III, 179.
Rosenbach, O., II, 447.
Rosenberger, F., III, 289.
Rosenthal, L., II, 306.
Rosenthal, W., II, 465.
Roshem, J., II, 266, 269, 442.
Ross, *Sir* E. D., III, 213, 218, 328.
Ross, *Sir* R., III, 117.
Rossi, G. (de), II, 210.
Rost, R., III, 197.
Rostagno, E., III, 332.
Roth, P., II, 440.
Roth, R., III, 183, 188.
Rothschild, *Lord*, II, 166.
Rouelle, III, 26, 445.
Rougier, L., II, 287; III, 492.
Roule, L., II, 465.
Rousiers, P. (de), II, 471.
Rousseau, J. J., II, 272, 274, 473.
Roussel, P., III, 93.
Rousset, H., II, 294.
Roustand, D., II, 284.
Rouvre, C. (de), III, 119.
Roux, P., II, 471.
Rowald, P., II, 432.
Roy, P. S., III, 148.
Royce, J., II, 284, 451; III, 368 sq., 389.
Royce, Katharine, III, 368.
Royds, T. F., II, 205; III, 93.
Royers, A., III, 218.
Royster, H. A., III, 119.
Rubens, H., II, 194.
Rucker, M., II, 266.
Rudejew, M., III, 122.
Rudio, F., II, 160, 272, 445; III, 115.
Rudolphi, K. A., III, 483.
Ruffer, M. A., II, 253.
Ruge, A., II, 244, 284.
Ruggiero, G. (de), II, 284.
Ruini, C., II, 57.
Rumi, Jalal Ad-Din, III, 475.
Rumph, G. E., III, 340.
Runkle, C. B., II, 407.
Ruppel, S., II, 278.
Rush, B., III, 341.
Ruska, J., II, 258, 259, 290; III, 303-305, 352, 443-444, 454, 456, 476, 477, 487.
Russell, A. S., III, 309, 495.
Russell, B., II, 284, 310, 452; III, 143, 311-314, 361, 488 .
Russell, E. S., II, 202 sq., 292; III, 128.
Russier, H., III, 216.
Rutherford, *Sir* E., III, 61.
Rutot, A., II, 234.
Rydberg, II, 456.

S

Saccheri, G., II, 445.
Sacchi, P., III, 25.
Sachau, E. C., II, 356; III, 217.
Sachs, Hans, II, 297.
Sachs, J. (von), II, 217; III, 297 sq.
Sacrobosco, II, 439; III, 396 sq., 409, 410, 411, 412, 413.
Sadajiro Sugiura, III, 215.
Sadanojo Matsunaga, III, 113.
Sadebeck, III, 439.
Saeki, P. Yoshio, III, 96.
Safford, J. M., II, 373.
Safford, W. E., III, 106 sq., 134.
Sageret, A., III, 345.
Sageret, J., III, 448-449, 492.
Sagher, H. (de), II, 459.

Said, abu, el Sigzi, II, 355.
Sainte-Beuve, III, 47.
Saint-Germain, B. (de), II, 59; III, 45.
St Guyard, III, 185.
St-Hilaire, G., II, 228; III, 467.
Sainton, II, 69, 74.
Saint-Pierre, *l'abbé* de, II, 420.
Saint-Saëns, C., 482.
Saint-Simon, II, 278, 423.
Saint-Yves, Isabelle, II, 467.
Saintyves, P., II, 242 sq., 478; III, 144.
Sala, A., II, 267.
Saladin, H., III, 218.
Saladini *de Asculo*, III, 330.
Salah ud-Din Musa, II, 413.
Salembier, L., II, 263.
Salet, P., II, 435.
Salicet, G. (de), II, 68.
Salisbury, R. D., II, 394.
Sallet, A. (von), II, 209.
Sallum, ibn, III, 328.
Salmanas, III, 304.
Salmon, G., III, 417.
Salusbury, T., III, 110.
Salvio, A. (de), II, 442; III, 110.
Salzmann, L. F., II, 257.
Samasrami, S., III, 188.
Sanchez, F., II, 267.
Sanchez, R., III, 32.
Sanctorius, S., II, 267; III, 35, 36, 43, 339.
Sandberg, G., III, 210.
Sandris, J. (de), III, 29, 45.
Sandys, *Sir* J. E., II, 439; III, 325.
Santini, G., II, 399.
Santorini, J. D., III, 45.
Santorio, III, 339.
Sarasin, F., II, 166; III, 115.
Sarason, D., II, 307.
Sarat Chandra Das, III, 210.
Sarkar, Benoy Kumar, III, 63 sq., 139, 206, 473, 474.
Sarlo, F. (de), III, 494.
Sarpi, *Fra* P., II, 58.
Sarton, George, *passim*.
Sastri, Sivanath, III, 428, 429, 469, 474.
Saussure, L. (de), III, 125, 131.
Sauvages, F. B. (de), II, 64; III, 46.
Sauveur, M., II, 286.
Sawaguchi Kazuyuki, II, 25.
Saxe, A. (de), III, 41.
Saxl, F., III, 476.
Sayana *Acharya*, III, 188-190.
Sayce, A. H., II, 431; III, 91.
Sayers, W. C. B., III, 127.
Scala, R. (von), II, 428.
Schachner, A., II, 278.
Schachtzabel, A., II, 428.
Schaefer, R. J., II, 263.
Schaer, E., II, 260.
Schäfer, II, 152.
Schafer, *Sir* E. S., III, 61.
Schaff, D. S., III, 102.
Schagen, II, 44.
Schairer, J., II, 433.
Scheben, L., II, 304.
Scheele, C. W., II, 169, 273.
Schefer, C., II, 140, 169.
Scheiner, C., II, 62; III, 35.
Schelenz, H., II, 264, 307, 442; III, 107, 366.
Schelling, F. W. J. (von), II, 273, 399.
Schemann, L., II, 449.
Scheppig, R., III, 388.
Scherman, L., III, 176, 187.
Schiaparelli, G., II, 203, 287.
Schiefner, A., III, 211.
Schiff, J., III, 95, 347, 454, 467.

Schille, J. (van), II, 441.
Schiller, F. (von), II, 276.
Schiller, F. C. S., II, 284; III, 153.
Schimmack, R., II, 453.
Schinnerer, J., II, 400.
Schindler, B., III, 132.
Schjellerup, II, 401.
Schlaginweit, E. (de), III, 211.
Schlegel, E., III, 25.
Schleiden, J., III, 484.
Schleier, II, 446.
Schlesinger, L., II, 272, 445.
Schlömilch, O., II, 135.
Schmarsow, A., II, 476.
Schmid, B., III, 357.
Schmidt, A., II, 400.
Schmidt, C., II, 374; III, 452.
Schmidt, J. C. E., III, 438.
Schmidt, R., III, 201.
Schmidt, W., III, 215.
Schmutzer, *D^r*, II, 267, 274.
Schmutzer, R., II, 274.
Schneider, A., II, 261, 262.
Schneider, C. V., II, 55.
Schoeffler, H., III, 365.
Schoepperle, G., III, 480.
Schomerus, H. W., III, 196.
Schonack, W., II, 255.
Schönbein, C. F., II, 281.
Schönberger, U., II, 268.
Schönlein, II, 279.
Schopenhauer, A., II, 279; III, 30, 440.
Schopenhauer, Johanna, II, 276.
Schöppler, H., II, 270, 274.
Schorlemmer, C., III, 440.
Schottenloher, K., II, 265.
Schoy, K., II, 259; III, 352, 455, 470, 477, 478, 483.
Schrader, O., III, 196.
Schramm, *D^r*, II, 478.
Schreckenfuchs, E. O., II, 206.
Schreiber, J. F., III, 33.
Schröder, H., II, 298.
Schröder, L. (von), III, 81 sq., 187, 201, 474.
Schubert, G. H., III, 347.
Schubring, W., III, 176.
Schuchert, C., III, 116.
Schück, A., II, 439; III, 350.
Schultens, III, 32.
Schultz, J., II, 292.
Schultz, W., II, 308.
Schultze-Fahrenwalde, M., II, 475.
Schulz, A., II, 304.
Schulze, J. H., III, 337.
Schurtz, H., II, 240, 428.
Schuster, A., III, 151.
Schuster, J., II, 274.
Schütte, G., III, 422 sq., 453.
Schutzenberger, III, 118.
Schuyl, F., II, 44, 65, 70; III, 22.
Schwann, II, 460.
Schwartz, C. (von), II, 323.
Schwarz, F. (von), III, 209.
Schwarz, I., II, 267.
Schwarz, P., III, 478.
Schweitzer, A. R., II, 284.
Schwenter, D., III, 338, 339.
Schweydar, II, 193.
Sckiff, II, 172.
Scott, J., III, 355.
Scot, Michael, III, 145, 263.
Scott, R. F., II, 282.
Scott, *Sir* W., II, 102.
Scott, W. A., III, 132.
Scotus, John, *Erigena*, II, 438.
Scriven, E., III, 285.
Scuderi, III, 45.
Séailles, II, 76; III, 37.
Seal, Brajendranath, III, 63 sq., 72 sq., 139, 474.
Sebiz, M., III, 458.

Sedgwick, A., II, 365.
Sedgwick, W. T., III, 151.
Sédillot, II, 413.
Sedley, *the Lady*, II, 269.
See, T. J. J., II, 455.
Seebeck, II, 456.
Seebohm, F., II, 307.
Seelmatter, II, 78.
Seely, Caroline E., III, 143.
Segner, J. A., III, 464.
Segre, A., III, 132.
Séguin, E., II, 467; III, 117.
Sehütte, G., III, 320.
Seidel, E., II, 259; III, 328.
Seidlitz, G. (von), III, 371.
Seki Kowa, II, 9-29 411 sq.; III, [111.
Seler, E., III, 293.
Seligmann, C., II, 253.
Seligmann, S., III, 354.
Selwyn, A. R. C., II, 374.
Semper,, M., II, 447.
Senac, II, 60.
Sénart, E., III, 194, 203, 205, 452.
Senebier, II, 65, 210.
Seneca, Lucius Annæus, III, 94.
Sennert, D., II, 84; III, 25, 26.
Serenus, Quintus, III, 320.
Sergeaunt, G., III, 453.
Sergius, Marcus, III, 318.
Serres, O. (de), III, 51.
Servet, M., II, 57, 77, 266.
Seshachari, III, 190.
Settala, M., III, 336.
Sette, V., III, 345.
Severino, II, 228.
Sewastionow, III, 422.
Seybold, C. F., III, 456.
Seydel, R., III, 209.
Shackleton, *Sir* E., III, 347.
Shaftesbury, *Lord*, II, 444.
Shakespeare, II, 442 sq.; III, 105, 106, 107.
Shand, A. F., II, 468.
Shannon, R., III, 463.
Shaw, J. B., III, 363.
Shaw, *Sir* N., III, 147.
Sheed, J. C., II, 280.
Sheppard, S. E., II, 458.
Sheppard, T., II, 361; III, 115.
Shimada Shosei, II, 24, 25.
Shipley, A. E., III, 151.
Schippen, W., III, 113.
Shufeldt, R. W., II, 465.
Sidersky, D., II, 251; III, 469, 488.
Sidgwick, H., II, 300.
Siebold, II, 198.
Siedler, P., III, 346.
Siegling, W., III, 204.
Siemens, II, 448, 456.
Sihler, E. G., III, 135.
Sikes, E. E., II, 255.
Silberer, H., III, 365.
Silberstein, L., II, 455; III, 147.
Silvaticus, J. B., II, 443.
Silvius, J., II, 44, 45, 55, 56, 61, 88.
Simmel, II, 293.
Simon, M., III, 16, 351.
Simon, R., III, 189, 208.
Simplicius, III, 7, 12, 16, 17.
Simpson, *Sir* A., III, 342.
Simpson, G. E., III, 333.
Sinapius, II, 269.
Singer, M^rs^ A. P., II, 259.
Singer, C., II, 298, 467; III, 94, 97-100, 102, 107, 108, 115, 145, 152, 263-269, 271 sq., 279-282, 297-299, 307-309, 316-371 *passim*, 435-437, 451-497 *passim*.
Singer, Dorothea, W., II, 298; III, 97, 100, 107, 271-274, 327, 480.
Siret, L., II, 302.
Sirkar, Kishori Lal, III, 475.

Sirks, M. J., III, 358.
Sismonda, A., II, 373.
Skoda, III, 346.
Slade, W. A., II, 149.
Slane, III, 477.
Slaught, H. E., III, 491.
Slegel, II, 52, 54.
Slocum, S. E., III, 490.
Sluze, R. F., II, 115.
Smiles, S., II, 290.
Smith, C., III, 417.
Smith, D. E., II, 356, 410-413; III, 98, 107, 112, 117, 141-143, 362, 459, 479, 490.
Smith, Edgar F., II, 458; III, 130, 464.
Smith, Emily, A., II, 447.
Smith, Eug. A., II, 374.
Smith, *Sir* F., III, 307 sq., 492.
Smith, F. E., II, 218.
Smith, G. E., II, 253; III, 149.
Smith, G. O., II, 378; III, 116.
Smith, H. F. R., II, 444.
Smith, H. J. S., III, 291.
Smith, N., II, 447.
Smith, P., II, 479.
Smith, S., III, 117.
Smith, V. A., II, 406; III, 83, 109, 139, 202-204, 207, 210, 319.
Smith, W., II, 361-363, 371; III, 115.
Smith, W. F., III, 107, 459.
Smithson, J., III, 116.
Smyth, R. B., II, 373.
Snel, W., II, 268; III, 335, 392.
Sobrero, A., II, 279, 448.
Socrates, III, 91, 317.
Soddy, F., III, 61, 369.
Söderbaum, H. G., II, 275.
Soderini, P., III, 108.
Soldner, J. G. (von), III, 438, 466.
Sollas, Hertha B. C., II, 389.
Sollas, W. J., II, 389.
Söllner, A., II, 257.
Solms-Laubach, H. (zu), III, 295.
Solomon, J., III, 91.
Solvay, E., II, 193, 194, 196; III, 115-117, 119, 120.
Soman, M., II, 449.
Sombart, W., II, 471.
Somigliana, II, 181.
Sommerfeld, A., II, 194.
Soranus *of Ephesus*, II, 256; III, 348.
Sorre, M., II, 463.
Sosman, R. B., III, 116.
Sotheran, H., II, 283; III, 132.
Soury, J., II, 41, 61, 67, 69-71, 73, 75, 78, 79, 86; III, 24, 37, 48.
Southwell, T., III, 371.
Spalding, II, 85.
Spallanzani, L., II, 60, 65, 209-213, 228, 273; III, 113.
Spampanato, V., II, 206-208; III, 107.
Spath, J. L., III, 438.
Spencer, H., III, 346, 350, 375-390, 468.
Spenser, E., II, 442.
Speyer, J. S., III, 183, 200.
Speyerer, K., III, 342.
Spidberg, J. K., III, 341.
Spiegel, F., III, 209.
Spielman, H., II, 168.
Spiers, F. S., III, 479.
Spiess, III, 25.
Spigel, II, 62.
Spinden, H. G., III, 292.
Spinoza, B. (de), II, 70, 78, 444; III, 33.
Spivak, C. D., III, 140.
Spœhr, H. A., III, 358.

Spooner, B., III, 207.
Sprat, T., II, 61.
Sprengel, K., II, 42, 43, 45, 52, 54, 55, 57, 60, 64-66, 77, 79, 142 sq.; III, 22-26, 28, 31-33, 36, 43, 46, 47.
Spurgeon, Caroline F. E., III, [100.
Sridhara, *see* Çridhara.
Stäckel, P., II, 138, 272, 274, 280, 445, 453; III, 363.
Stadler, D., II, 67.
Stadler, H., II, 154, 262.
Staehlin, W., II, 479.
Stahl, G. E. (von), II, 40, 51, 78, 88, 288; III, 32, 45, 109, 440.
Stamm, E., II, 271.
Stanford, C. V., III, 124.
Stanford, E., II, 260.
Stanhope, C., *Earl*, II, 447.
Stanhope, Ghita, II, 447.
Stanmore, *Lord*, II, 403.
Staring, W. C. H., II, 373.
Stas, II, 279.
Stcherbatsky, T. (de), III, 192, 194, 211, 250.
Steckel, W., II, 300.
Steele, R. R., III, 272, 326.
Steerath, E., II, 152.
Stefanini, III, 60.
Stehlin, K., II, 257.
Steier, A., II, 202, 254; III, 92.
Stein, J. B., II, 278.
Stein, J. P. W., III, 439.
Stein, *Sir* M. A., II, 260; III, 177, 204, 213.
Stein, R., III, 342-344, 368, 369, 464.
Steiner, J., II, 284; III, 465.
Steinheil, II, 275.
Steinmann, H. G., II, 271.
Steinschneider, M., II, 134; III, 425.
Stelluti, F., III, 27.
Steno, N., II, 55, 71, 73, 78, 358; III, 29, 51, 112, 445.
Stephanescu, G., II, 377.
Stephanides, M. C., III, 348, 430-433, 470, 471.
Stephanos *of Alexandria*, III, 304.
Stephen, H., III, 61.
Stephens, J. L., III, 292.
Steppes, K., III, 439.
Sterrett, J. R. S., III, 318.
Steuernagel, C., II, 258.
Stevens, N. E., III, 345.
Stevenson, E. L., III, 107.
Stevenson, J., II, 51.
Stevenson, M^{rs} S., III, 195.
Stevin, S., II, 267; III, 458.
Stewart, A. W., III, 130.
Stewart, D., III, 289.
Sticker, G., II, 150, 257, 298; III, 328.
Stifel, III, 286.
Stiles, W., III, 113.
Stillman, J. M., III, 102, 107.
Stirling, J., II, 275.
Stirling, W., II, 57.
Stock, S^{t} G., III, 91.
Stockberger, W. W., II, 465.
Stoddart, Annie, II, 442.
Stokes, *Sir* G. G., II, 180; III, 291.
Stokes, W., III, 177, 182.
Stoll, M., II, 152.
Stolz, III, 307.
Stone, III, 340.
Stone, S., II, 465.
Stose, G. W., II, 380.
Stott, W., III, 142.
Strabo, III, 318.
Strabo, W., III, 321.
Strack, III, 176.
Strange, E. F., II, 437.

Strato, II, 67; III, 279.
Stratton, G. M., III, 92.
Stratz, C. H., II, 306, 477.
Strauss, Bettina, II, 446.
Strauss, D. F., III, 381.
Strauss, O., III, 197.
Strecker, II, 184.
Streeter, E. C., II, 265; III, 102, 107.
Streit, P. C., II, 479.
Streitberg, W., III, 179, 182.
Stringham, I., III, 417.
Stroem, C., III, 31.
Stroh, A. H., II, 274.
Strohl, J., II, 465.
Stroobant, P., II, 191; III, 125.
Strunz, F., II, 155; III, 25.
Stryienski, C., III, 115.
Stübe, R., II, 141, 437.
Studer, B., II, 373, 377, 390.
Study, E., II, 286.
Sturgis, R., III, 124.
Suali, L., III, 73, 139, 192, 195, 219-254, 475.
Sudharkara Dvivedi, II, 355.
Sudhoff, K., II, 147-150, 154 sq., 261-265, 274, 278, 294, 298, 434, 441; III, 25, 100, 102, 104, 144, 150, 268, 318, 320-329, 333, 334, 348, 355, 455.
Suess, E., II, 357, 368 sq., 381, 382-392; III, 123, 341, 487.
Sufi, III, 451.
Suger, III, 97.
Summer, T. H., III, 118.
Sundmann, C. F., III, 343, 483.
Surijagoda Sumangala Thera, III, 138.
Suter, H., II, 356; III, 456.
Suzuki, D. T., II, 260; III, 76, 132, 150, 194.
Suzuki, Kwason, III, 75.
Svedberg, T., II, 289.
Swalse, III, 23.
Swammerdam, J., II, 62, 212, 228, 271.
Swan, *Sir* J. W., III, 123.
Swann, H. K., III, 371.
Swedenborg, E., II, 272-274; III, 341, 342.
Swieten, G. (van), II, 445; III, 45.
Swinney, S. H., II, 268.
Switalski, B. W., III, 268.
Sydenham, III, 26, 47.
Sykes, P. M., III, 140.
Sylvester, J. J., III, 291, 417.
Sylvius, F. De la Boë, II, 50 sq., 54, 55, 59, 65, 66; III, 23, 24, 26, 29, 109.
Synesios, III, 304.
Szalay, B., III, 154, 497.

T

Tabari, III, 352.
Taberndemontanus, III, 105.
Tabit b. Qorra b. Merwan, II, 354.
Tabor, J., III, 45.
Tachenius, O., III, 25.
Tagore, Abanindro Nath, III, 137, 139.
Tagore, Rabindranath, III, 101.
Taine, H. A., III, 241.
Tait, A., II, 167.
Tait, P. G., III, 291.
Takakusu, J., III, 191, 213, 214.
Takebe Kenko, II, 23, 30, 411 sq.
Tamman, G., II, 457.
Tannery, P., II, 37, 107, 109, 134, 203, 356; III, 13, 15-20, 277, 391.
Tantra, III, 471.

T'ao, Li Kung, III, 131.
Taranatha Viclyaratna, III, 81, 211.
Taranzano, C., III, 132.
Tarde, J., III, 35.
Tartaglia, N., II, 167; III, 107.
Tassy, G. (de), II, 199.
Tastevin, J., II, 299, 300.
Tavernier, J. B., III, 218.
Taylor, A. E., III, 91, 277, 317.
Taylor, H. O., II, 257.
Taylor, J., II, 478.
Taylor, M. V., III, 272.
Tchoang tse, II, 437.
Tedder, H. R., II, 153; III, 388.
Teicher, T., III, 114.
Teixeira, F. G., II, 106.
Telesio, B., II, 85, 206-208; III, 107.
Tempier, E., III, 39.
Temple, *Sir* R. C., II, 443.
Tenneman, W. G., III, 12.
Ternier, P., II, 391, 392; III, 135.
Terquem, O., II, 133.
Terry, T. P., II, 261.
Tertullian, II, 67.
Terzaghi, N., II, 399.
Terzaghi, P. M., II, 443.
Testi, F., II, 297.
Tetbert, II, 438.
Teubner, B. G., II, 138.
Teuffel, R., II, 438.
Tfinkdji, J., II, 307.
Thabit ben Corra, III, 145.
Thacher, J. B., III, 328.
Thales, III, 304.
Theætetus, II, 256.
Theal, G. M., III, 360.
Themison *of Laodicea*, III, 348.
Thenard, L. J., II, 169.
Theodoret, III, 112.
Theodorus, *of Cyrene*, II, 256.
Theophilus, III, 305, 322.
Theophrastus Christianus, III, 304.
Theophrastus, Eresius, II, 67; III, 92, 357.
Theophylactus, III, 323.
Théry, R., II, 470.
Thesing, C., III, 357.
Thessalos *of Tralles*, II, 205; III, 348.
Thibaut, G., II, 355, 356, 407; III, 87, 192, 193, 206, 305.
Thibaut, P., II, 268.
Thierfelder, A., II, 300.
Thierfelder, J. G., II, 143.
Thin, J., II, 168.
Thirion, J., II, 255; III, 99.
Thiselton-Dyer, *Sir* W., III, 92.
Thiville, B. (de), III, 371.
Thole, F. B., II, 456.
Thomas, *Saint*, III, 209.
Thomas Alvarus, III, 107, 142.
Thomas Aquinas, *Saint*, II, 63, 68, 69, 85 sq., 262; III, 145.
Thomas, C., III, 293.
Thomas, F. W., III, 138, 176, 178, 195, 199, 206.
Thomas, L. A., III, 138, 206.
Thomas, W., III, 204.
Thompson, C. J. S., II, 299.
Thompson, D'A. W., III, 128.
Thompson, S. P., II, 291, 457.
Thomsen, A., III, 30.
Thomson, J., II, 280.
Thomson, J. A., II, 461.
Thomson, J. A. K., III, 136.
Thomson, *Sir* J. J., II, 290; III, 61, 122, 364.
Thomson, T., II, 69.
Thomson, W., *see* Kelvin, *Lord*.
Thorndike, L., III, 145, 274.
Thorpe, *Sir* E., III, 61.

Thou, J. (de), II, 419.
Thouverez, E., II, 42, 81.
Thoynard, N., II, 271.
Thrämer, E., III, 318.
Thulin, C., II, 432.
Thumb, A., III, 184.
Thurmann, J., II, 372.
Thurston, E., III, 204, 205.
Thurston, M., II, 51.
Thury, C. (de), II, 370.
Tiberghien, A., II, 270.
Tiedemann, D., III, 112.
Tiedemann, F., II, 279.
Tietze, H., II, 476, 477.
Tiffeneau, M., III, 119.
Tifushi, III, 353.
Tilden, *Sir* W. A., II, 282; III, 61, 119, 122.
Tillé, A., II, 239 sq., 428; III, 137, 488.
Tingry, F., II, 446.
Tiraboschi, G., II, 45; III, 34.
Tisserand, II, 192, 424.
Tissot, II, 374.
Tizio, S., II, 265.
Tobar, J., II, 436.
Tod, M. N., II, 255.
Todd, T. W., III, 274.
Todhunter, I., III, 291, 416, 439.
Todi, J. (da), II, 439, 440; III, 456.
Toeche-Mittler, T., II, 244.
Toita Yasusuke, II, 18-24, 35.
Toletus, II, 78.
Tollington, R. B., II, 432.
Tolman, R. C., III, 364.
Tolstoi, II, 399; III, 75.
Tongo Tabeke, II, 437.
Tonini, G., III, 332.
T'on-mi (*or* T'ou-mi), III, 322.
Tonni-Bazza, V., II, 167.
Tönnies, F., II, 471.
Tooley, M^rs Sarah A., III, 122.
Topley, W., II, 376, 378.
Topley, W. W., III, 125.
Torkomian, V. H., III, 329.
Torre, G. (della), III, 41, 43.
Torre, M.-A. (della), III, 38.
Torre-Velez, *le comte de*, II, 468.
Torres y Quevedo, L., III, 117.
Torricelli, E., II, 268; III, 339, 340.
Totzauer, R., II, 278.
Tournefort, III, 445.
Tourville, H. (de), II, 278, 471.
Tout, II, 213.
Townsend, J. S., III, 61.
Toy, C. H., II, 308.
Toynbee, P., III, 99.
Traube, J., II, 461.
Trebitsch, R., II, 304.
Treffel, G., III, 122.
Treutlein, P., III, 398.
Treviranus, III, 440, 483.
Triaire, P., II, 148.
Troilo, E., II, 155, 207.
Troland, L. T., II, 292.
Tronchin, T., II, 446.
Tronnier, A., II, 278, 400.
Troostwyk (van), II, 456.
Trublet, II, 80.
Trübner, III, 181.
True, R. H., III, 115, 358.
Trullius, J., II, 54.
Trumpp, E., III, 186.
Tschouprof, A., II, 395.
Tuckermann, E., III, 345.
Turchi, N., II, 480.
Türck, H., II, 480.
Turner, J. E., III, 129.
Turre, Joannes A., II, 52.
Turrière, E., II, 106-124, 424 sq.; III, 119, 344.
Turró, R., II, 284.

Tuxen, P., III, 192.
Tweedie, C., III, 289 sq., 464.
Tyler, H. W., III, 151.
Tyndall, J., III, 61.

U

Udden, J. A., II, 451.
Ueberweg, F., III, 12.
Uechtritz, M. V., III, 114.
Uhlenhuth, III, 484.
Uhlig, G., II, 280.
Ulpian, III, 263.
Ulugh Beg Ibn Shahrukh, Mirza, II, 413-415, 421 sq.; III, 101, 457.
Ulstadt, III, 103.
Umano, II, 472.
Underhill, Evelyn, III, 101, 456.
Unold, J., II, 310.
Unwin, W. C., III, 61.
Uziglio, G., II, 279.
Utitz, E., II, 306.
Uzureau, F., II, 278.

V

Vacaspatimicra, III, 191, 192, 250.
Vaidya, C. V., III, 198.
Vailati, G., II, 246; III, 367.
Valcarenghi, P., III, 30.
Valdarmini, A., II, 274.
Valdizian, H., II, 442.
Valentin, G., II, 280.
Valerio, L., II, 267.
Vallauri, M., III, 322, 475.
Vallery-Radot, R., II, 449.
Vallès, F., II, 56, 85 sq.
Vallisnieri, A., II, 212; III, 336.
Vallon, C., II, 443.
Valois, J., III, 335.
Valois, L. E. (de), III, 335.
Valsalva, A. M., II, 213; III, 34, 334.
Vanderbank, III, 285.
Vandermonde, A. T., III, 415.
Vandevyver, L. M., II, 455.
Van Gehuchten, A., III, 123.
Vangensten, O. C. L., II, 265; 440; III, 104.
Van Hee, L., II, 260; III, 99, 112, 119.
Van Langenhove, F., III, 123.
Van Leersum, E. C., II, 146; III, 38, 343.
Van t' Hof, III, 428.
Van 't Hoff, J. H., III, 345.
Van Tiegham, P., III, 123.
Varāha Mihira, II, 327, 332, 355.
Varendonck, J., II, 472.
Varignon, P., II, 123, 124.
Varole, II, 43, 66, 69.
Varon, G., III, 39.
Vasari, III, 38, 457.
Vassilief, A., II, 395.
Vassura, G., III, 340.
Vasubandhu, III, 194 sq.
Vatsyayana, III, 228 sq., 250.
Vaughan, T. W., III, 361.
Vauthier, M., II, 472.
Vaux,Clotilde (de), III, 119.
Venturi, A., II, 476.
Venturi, L., III, 458.
Veranzio, F., III, 338.
Verbiest, II, 268.
Verdier, H., II, 49, 73, 88, 265; III, 37, 38.
Verga, E., III, 104, 331, 458.
Verheyen, III, 29.
Verlot, B., III, 345.
Vermeil de Conchard, *colonel*, II, 447.
Véronnet, A., II, 453.

Verneuil, II, 372, 373.
Verrall, A. W., II, 256.
Verril, A. E., II, 465.
Verworn, M., II, 40, 41; III, 484.
Vésale, A., II, 43-45, 57, 61, 64, 73, 88, 168, 228; III, 106, 331.
Vesalius, III, 458.
Vespucci, A., III, 107 sq.
Vessiot, E., III, 117.
Viallate, A., II, 472; III, 361.
Viana, O., III, 334.
Vico, G. B., II, 271.
Vidal, C., II, 446.
Vidal, E., II, 429.
Vidyabhusana, S., III, 195.
Vidyapati, III, 103.
Vierordt, H., II, 270, 274; III, 365.
Viète, F., III, 105, 392.
Viets, H., III, 112.
Vieussens, II, 59, 65, 71; III, 22 sq.
Vigevano, G. (da), II, 263; III, 326.
Vigneron, H., II, 457.
Vijnana Bhiksu, III, 191.
Vijnmalen, III, 176.
Villa Dei, A. (de), III, 396, 413.
Villegagnon, II, 169.
Villeneuve, H. (de), III, 37.
Villers, R., II, 280.
Villey, P., II, 81.
Villiers, B. (de), II, 372.
Villiers, J. A. J. (de), II, 140.
Vincent, E., III, 350.
Vincent, L., II, 470.
Vincent, M., II, 289.
Vinchon, J., II, 273, 299.
Vinci, Leonardo (da), II, 49, 56, 73, 74, 97, 207, 228, 264, 265, 358, 440; III, 35, 37, 38, 102-04, 127, 330, 331, 368, 371, 457.
Vindicianus, III, 324.
Vines, S. H., II, 271.
Vinogradoff, P., II, 472.
Vinson, J., III, 185.
Virchow, R., III, 484.
Viré, II, 101.
Virey, II, 79.
Virga, A. (de), III, 456.
Virgil, II, 205; III, 93, 453.
Virgil, *saint*, II, 437.
Virolleaud, C., III, 482.
Visconti, L., II, 399.
Visiani, R. (de), III, 60.
Vitali, G., II, 399.
Vitruvius, II, 257; III, 93.
Vivaldi, M., III, 345.
Vivekananda, *Svami*, III, 192.
Vivès, J. L., III, 41.
Vloten, J. (van), II, 444.
Voelcker, K., II, 267.
Vogel, J. P., III, 202.
Vogel, O., II, 274; III, 462.
Vogt, H., II, 256, 356.
Vogt, P. L., II, 467; III, 423.
Voigt, A., II, 293.
Voisins, d'Aubuisson (de), II, 359.
Vollers, III, 176.
Vollgraff, J. A., II, 268.
Vollmer, F., III, 320 sq.
Volta, II, 276, 456; III, 113.
Voltaire, II, 81, 198, 473; III, 112.
Volterra, V., II, 454.
Vorberg, G., II, 274.
Vortish van Vloten, H., II, 261.
Voss, A., II, 465.
Vossion, L., III, 215.
Voynich, W. M. (de), III, 108.
Vram, U. G., III, 340.
Vreede, A. C., III, 217.
Vriberg, Theodoricus Teutonicus de, *see* Freiberg, Dietrich (von).

Vrinda-Madhava, III, 322.
Vrooman, H., II, 470.
Vuillemin, P., III, 121.
Vulpian, A., II, 278.
Vyasa, III, 192.

W

Waard, C. (de), II, 270.
Wackernagel, J., III, 180, 182.
Wada Nei, II, 412.
Waddell, L. A., III, 211.
Waddington, C., III, 48.
Wagner, J., II, 472.
Wagner, R., II, 449.
Waite, A. E., III, 87 sq., 479.
Walæus, J., II, 54, 55.
Walcher *of Malvern*, III, 398.
Walcott, C. D., III, 116.
Walker, E., III, 61.
Walker, F. G., II, 252.
Wallace, A. R., II, 310, 379.
Wallace, W., III, 124.
Wallas, G., II, 472.
Walle, P., II, 463.
Wallensis, Thomas, III, 281.
Walleser, M., III, 193, 195.
Wallis, C. E., III, 144.
Wallis, J., II, 115, 118, 123; III, 55, 112, 255, 447.
Walsh, J. J., II, 297; III, 308 sq., 365, 480.
Walther, W., II, 240.
Wang-an-Shih, II, 260.
Wang Hien-Tsé, III, 214.
Wang-Yang-Ming, II, 260; III, 101.
Warburg, E., II, 194; III, 147.
Warburton, H., III, 414.
Ward, B. R., III, 120.
Ward, J., II, 306.
Ward, James, II, 300.
Ward, John, III, 340.
Ward, W. H., III, 356.
Wardrop, O., II, 434.
Warren, *Sir* C., II, 251.
Warren, Howard C., III, 126, 128.
Warren, H. Clarke, III, 193.
Warren, H. L., III, 93.
Warren, J. C., III, 343.
Warton, T., II, 61.
Wasiliewski, W. (von), II, 307.
Wasmann, E., II, 261.
Wassilieff, V., III, 194.
Waterhouse, C. O., II, 295.
Waterhouse, G., II, 270.
Waterlow, S., III, 91, 369.
Wateson, G., III, 108.
Watson, E., III, 133.
Watt, J., II, 397; III, 342.
Watt, *Sir* G., III, 208.
Watt, J., III, 464.
Waxweiler, E., III, 123.
Weaver, J. H., III, 490.
Weber, A., III, 87, 117, 176, 187, 189, 198, 209.
Weber, F. P., II, 305.
Weber, L., II, 310.
Weber, O., II, 240.
Weber, W. E., II, 218, 223; III, 28.
Webster, H., III, 134.
Wedemeyer, A., II, 435.
Wefa, abu'l, el Buzgani, II, 355.
Wegener, G., II, 401.
Wegerdt, K., II, 428.
Weidner, E. F., III, 91, 126, 349.
Weierstrass, II, 273.
Weil, G., III, 352.
Weinreich, H., II, 453.
Weir, T. H., III, 352.
Weismann, A., II, 293.
Weiss, P., II, 197, 289.

Welch, W. H., II, 447.
Wellcome, H. S., II, 253, 304.
Wellhausen, J., III, 352.
Wellmann, M., II, 73, 257; III, 319.
Wells, H. L., III, 116.
Wells, W., III, 416.
Wells, W. C., III, 147.
Wenod, J., III, 102.
Wensinck, A. J., III, 353.
Wentworth, G. A., III, 416.
Wepfer, J. J., II, 59 sq., 62, 75; III, 25.
Werner, III, 445.
Werner, A., II, 290, 458; III, 428.
Werner, A. G., II, 359 sqq.
Werner, C., II, 285.
Werner, E. T. C., III, 350, 388.
Werner, J., II, 205 sq.; III, 108.
Wernick, G., III, 122.
Wescham, Thomas (de), II, 262.
Wesenberg-Lund, C., II, 295.
Wesley, J., II, 446.
Westaway, F. W., III, 369.
Westenberger, I., II, 431; III, 319.
Westinghouse, G., III, 118.
Westland, A. Mildred, III, 100, 102.
Weston, E., III, 115.
Weston, T., III, 110.
Weyer, J., II, 108.
Weyprecht, C., II, 279.
Wheeler, G. C., III, 134.
Whetstone, G., III, 108.
Whetzel, H. H., III, 129.
Whewell, W., III, 291.
Whibley, L., III, 136.
Whish, III, 178.
Whitbeck, R. H., III, 361.
White, *Sir* W. H., II, 168; III, 123.
Whitebread, H., III, 196.
Whitehead, A. N., III, 311 sq.
Whitney, G., II, 355.
Whitney, W., III, 183, 188.
Whittaker, E. T., II, 222-224; III, 147.
Whittaker, T., III, 351.
Whyte, R., III, 185.
Whytt, R., II, 60, 80, 87.
Wichmann, A., II, 464.
Wichura, M., III, 345.
Wickersheimer, E., II, 43, 45, 147, 150, 151, 263, 264, 298, 307, 467; III, 144, 326, 329, 464.
Wickremasinghe, III, 177.
Wiedemann, Eilhard, II, 206, 259, 288, 356, 434, 435, 439; III, 324, 353, 475, 478.
Wiedemann, Ernst, III, 120.
Wiedemann, G. H., III, 120.
Wieder, F. C., III, 360.
Wieger, L., II, 437; III, 214.
Wiegmann, A. F., III, 345.
Wieleitner, H., II, 106, 275, 443; III, 100, 115, 142, 334, 340, 362, 462.
Wien, W., II, 289; III, 366.
Wiener, L., III, 140.
Wieser, F. R. (von), III, 456.
Wigmore, J., II, 297.
Wilczek, E., II, 428.
Wilczynski, E. J., III, 362.
Wilkinson, L., II, 355.
Willem, V., III, 123.
Williams, A. V., III, 475.
Williams, C. M., III, 369.
Williams, L. F. R., III, 108, 204.
Williamson, A. W., II, 169; III, 428, 442.
Willis, B., II, 375, 380; III, 493.
Willis, T., II, 50, 62, 63, 67, 71, 75, 77-79, 228; III, 23, 24, 26, 112.

Willoughby, L. A., III, 454.
Wilser, L., II, 303, 304.
Wilson, E. A., II, 282.
Wilson, E. B., II, 182; III, 364.
Wilson, D. W., II, 449.
Wilson, H. H., III, 197, 201.
Wilson, J. C., II, 256.
Wilson, J. M., III, 61.
Wilson, M., III, 113.
Winckelmann, III, 113.
Winckler, H., II, 240.
Windelband, W., II, 284; III, 13.
Winderlich, A., II, 290.
Wingate, E., III, 335.
Winship, G. P., III, 103, 329.
Winslow, II, 71.
Winter, J. G., III, 112.
Winter, M., II, 286.
Winterberg, III, 439.
Winternitz, M., III, 174, 178, 194, 201.
Winthrop, J., III, 112.
Wirsung, II, 64.
Wissler, C., III, 134, 486.
Withering, W., III, 341.
Withers, H., II, 472.
Withington, E. T., II, 164; III, 108.
Wittgenstein, L., III, 313.
Witting, A., II, 285.
Wittwer, P. L., II, 152.
Woepcke, F., II, 356; III, 92.
Wöhler, III, 442.
Wolff, III, 33, 440.
Wölffing, E., II, 135.
Wolkenhauer, W., III, 487.
Wollaston, W. H., II, 168.
Woltmann, L., II, 234.
Wood, J., III, 186.
Wood, R. W., II, 457.
Woodhouse, III, 463.
Woodruff, L. L., III, 115.
Woods, F. A., II, 474.
Woods, J. H., II, 407; III, 192.
Woodward, A. S., III, 61.
Woodward, G. R., III, 96.
Woodward, H. B., II, 377, 379, 393.
Woodward, R. S., III, 368, 417.
Wormser, III, 340.
Wreszinski, W., III, 350.
Wright, A., III, 108.
Wright, E., III, 105.
Wright, F. E., III, 493.
Wright, J., III, 144, 317, 452.
Wright, T., II, 153.
Wright, W. B., II, 473.
Wrinch, Dorothy M., III, 120.
Wulf, M. (de), II, 75, 257, 433; III, 42.
Wundt, M., III, 452.
Wundt, W., III, 149.
Würschmidt, J., II, 205 sq., 440; III, 108, 327, 353, 366, 478, 479.
Wurtz, III, 428.

Y

Yamaji Shuju, II, 17, 18, 20.
Yearsley, M., II, 275.
Yelin, J. K. (von), III, 466.
Yin Wen Tseu, III, 92.
Yohannan, A., III, 475.
Youmans, E. L., III, 389.
Young, T., II, 223.
Yule, *Sir* H., II, 261; III, 132, 218.

Z

Zaccagnini, G., III, 334.
Zacchariæ, T., III, 184, 439.
Zacuto, III, 425.
Zahm, A. F., III, 120.

Zambaco, *Pacha*, II, 298.
Zancari, A. (de), III, 327.
Zanetti Bianco, O., II, 287.
Zangronitz (de), II, 81.
Zanta, Léontine, II, 442.
Zaunick, R., II, 448; III, 330, 334, 340, 365, 371.
Zawidzki, J. (von), II, 281.
Zedler, G., II, 400.
Zeeman, II, 223, 456.
Zeller, E., III, 12, 19, 31.
Zeller, J., II, 262.
Zenker, T., III, 175.
Zeno, II, 256; III, 7-20, 277, 312 sq., 317, 362, 452, 489.
Zerbi, III, 38.
Zeuthen, H. G., II, 256, 356, 453.
Ziebarth, E., II, 431.
Ziehen, T., II, 452.
Zimmer, G. F., III, 153.
Zimmerer, H., II, 240.
Zimmermann, L., III, 330.
Zimmermann, M., II, 293.
Zittel, K. A. (von), II, 294, 393; III, 441.
Zosimos, III, 304, 321.
Zsigmondy, R., II, 458.

5684. — Soc. an. M. Weissenbruch, imp. du Roi, 49, rue du Poinçon, Bruxelles.

N° 5 JUIN 1914

ISIS

REVUE CONSACRÉE A L'HISTOIRE ET A L'ORGANISATION DE LA SCIENCE, PUBLIÉE PAR GEORGE SARTON

TOME II (FASC. 1)

COMITÉ DE PATRONAGE :

Svante Arrhenius, directeur de l'Institut [illegible] Nobel, Stockholm; Paul Barr, directeur de la *Revue de synthèse historique*, Paris; Moritz Cantor, professeur émérite à l'Université d'Heidelberg; Franz Cumont, conservateur aux Musées royaux, Bruxelles; E. Durkheim, professeur à la Sorbonne, Paris; Jorge Engerrand, curateur de l'École internationale d'archéologie et d'ethnologie américaines, Mexico; Ant. Favaro, professeur à l'Université de Padoue; John Ferguson, professeur à l'Université de Glasgow; Arnold van Gennep, professeur à l'Université de Neuchâtel; E. Goblot, professeur à l'Université de Lyon; Io. Guareschi, professeur à l'Université de Turin; Siegmund Günther, professeur à l'École technique supérieure de Munich; Sir Thomas-L. Heath, K.C.B., F.R.S., Londres; J.-L. Heiberg, professeur à l'Université de Copenhague; Frédéric Houssay, professeur à la Sorbonne, Paris; Karl Lamprecht, professeur à l'Université de Leipzig; Jacques Loeb, member of the Rockefeller Institute for medical research, New-York; Gino Loria, professeur à l'Université de Gênes; Jean Mascart, directeur de l'Observatoire de Lyon; Walther Nay, professeur à l'École technique supérieure de Karlsruhe; G. Millhaud, professeur à la Sorbonne, Paris; Max Neuburger, professeur à l'Université de Vienne; Wilhelm Ostwald, professeur émérite à l'Université de Leipzig; Henri Poincaré †; Em. Radl, professeur à l'École réale, Prague; Sir William Ramsay, K.C.B., F.R.S., Londres; Prafulla Chandra Ray, professeur à Presidency College, Calcutta; Abel Rey, professeur à l'Université de Dijon; David Eugène Smith, professeur à Columbia University, New-York; Ludwig Stein, Herausgeber des *Archivs für Geschichte der Philosophie*; Karl Sudhoff, Direktor des Instituts für Geschichte der Medizin, Leipzig; E. Waxweiler, directeur de l'Institut de sociologie Solvay, Bruxelles; H.-G. Zeuthen, professeur à l'Université de Copenhague.

Administration et Rédaction d'ISIS
Wondelgem-lez-Gand
(Belgique).

Akademische Buchhandlung von Max Drechsel,
Hirschstrasse, 22, Bern
(Suisse).

ISIS

Revue Internationale consacrée à l'Histoire de la Science
:: et de la Civilisation ::

International Review devoted to the History
:: of Science and Civilization ::

EDITED BY GEORGE SARTON, D. Sc.
Associate of the Carnegie Institution, Washington, D. C.

Sept. 1919 II 2

N° 6. — TOME II (fasc. 2 et dernier).

Avant-Propos.

GEORGE SARTON. — War and Civilization (editorial).

PRAPHULLA CHANDRA RAY (Calcutta). — Chemical Knowledge of the Hindus of Old.

G. R. KAYE (Delhi). — Indian Mathematics.

GEORGE SARTON. — La Synthèse Géologique de 1775 à 1918.

Chronique et Correspondance : 11 notes.

Analyses : 17 ouvrages.

VI° Bibliographie critique de toutes les publications relatives à l'Histoire, la Philosophie et l'Organisation de la Science (jusqu'en août 1914).

Table méthodique des matières.

Soc. An. M. WEISSENBRUCH
Imprimeur du Roi
49, rue du Poinçon
Bruxelles (Belgique).

PAUL HAUPT
Librairie Académique.
(ci-devant MAX DRECHSEL)
Berne (Suisse).

Prix actuels (oct. 1919) : t. I, 80 fr.; t. II, 80 fr.; t. III (en souscription), 80 fr.

ISIS

Revue Internationale consacrée à l'Histoire de la Science
:: et de la Civilisation ::

International Review devoted to the History
:: of Science and Civilization ::

EDITED BY GEORGE SARTON, D. Sc.
Associate of the Carnegie Institution, Washington, D. C.

III 3

N° 7. — TOME III, 1 (jan. 1920).

GEORGE SARTON. — The Faith of a Humanist.

FLORIAN CAJORI (Berkeley, California). — The purpose of Zeno's arguments on motion.

AUG. GEORGES BERTHIER (Lyon). — Le mécanisme cartésien et la physiologie au XVII^e^ siècle (avec une note de Edmond GOBLOT)

Chronique et Correspondance : 4 notes.

Analyses : 14 notes dont 11 consacrées à l'Inde.

Seventh critical bibliography of the History, Philosophy and Organization of Science and of the History of Civilization (to June 1919).

Soc. An. M. WEISSENBRUCH
Imprimeur du Roi
49, rue du Poinçon
Bruxelles (Belgique).

PAUL HAUPT
Librairie Académique.
(ci-devant MAX DRECHSEL)
Berne (Suisse).

Prix : t. I, fr. belges, t. II et suivants 30 fr. (payables par anticipation)
Edition sur Hollande, t. II et suivants : 50 fr.

ISIS

International Review devoted to the History
:: of Science and Civilization ::

EDITED BY
GEORGE SARTON

III 3

N° 9, being the 3d and last part of Vol. III
Summer 1921.

CONTAINING :

GEORGE SARTON. — Herbert Spencer.
EDMOND GOBLOT. — Gaston Milhaud.
L. C. KARPINSKI. — Two Twelfth Century Algorisms.
FLORIAN CAJORI. — History of Symbols for *n*- Factorial.
Three shorter notes.
Seventeen reviews
Ninth Critical Bibliography of the History, Philosophy and Organization of Science and of the History of Civilization (to August 1920).

Soc. An. M. WEISSENBRUCH
Imprimeur du Roi
49, rue du Poinçon
Bruxelles (Belgique).

PAUL HAUPT
Librairie Académique.
(ci-devant MAX DRECHSEL)
Berne (Suisse).

Prix : t. I, II et III, 50 fr. belges chacun, (payables par anticipation)
Edition sur Hollande, t. II et III : 100 fr. chacun.

BRUXELLES
Société anonyme M. WEISSENBRUCH, imprimeur du Roi
(Société typographique : Liège, Bouillon, Paris, 1785-1793)
49, rue du Poinçon.

—

1921